APPENDICES

APPENDIX 1

STANDARD OPERATING PROCEDURES FOR SEDIMENT CORE COLLECTION

1. All data from sediment core collection will be recorded in the field database (Microsoft Access®) provided by QEA using a laptop computer on the sampling vessel. Upon completion of sampling at one location, all data from the core will be entered into the database and the field log for that location, printed, and the hard copy stored in the field notebook. This will limit the risk of losing core information due to computer failure. Blank field log sheets that can be used to record information manually also will be provided in case of difficulties with data entry into the computer on the boat are encountered. Manually recorded data will be transcribed into the field database at the end of each day.

2. If the water is too shallow for the sampling vessel to navigate (i.e., less than approximately 2 ft. of water), the location will be temporarily abandoned, and the field sampling coordinator will be notified. A sample will be collected subsequently using either a shallower draft sampling vessel or a push core will be taken from the sample location by wading into the river using chest waders. If the location is reached by wading, the GPS antenna will be hand carried to determine the coordinates of the actual sampling location.

3. Using the on-board GPS system, maneuver the sampling vessel to within 5 ft of the pre-programmed target coordinates for each sample location. Secure the vessel in place using spuds and/or anchors. Record in the field log the actual location from which the core was collected and the target location.

4. Use a calibrated steel rod to probe the sediment surface 3 to 5 ft away from the target location to determine the sediment thickness and type in accordance with the Sediment Probing SOP.

    - If the estimated sediment thickness at the probing area is greater than 6 inches, record probing information in the field log and attempt to collect a core using the vibracorer.

    - If the estimated sediment thickness at the probing area is less than 6 inches, additional probing of the sediment surface will be conducted within 10 ft of the target location for deeper sediments. If thicker sediments are found, relocate the boat to the new coordinates and attempt to collect a core. If sediment depth appears to be systematically less than 6 inches, make one attempt at collection with the vibracorer. If 60% recovery is not achieved after one attempt, collect a sample with a ponar dredge.

5. Once the targeted area is deemed suitable for core collection select an appropriate 3-inch (o.d.) core tube type (Lexan® or aluminum) and length based on the probing information. Use Lexan®

tubing in soft sediments and aluminum tubing for coarse sediments. The majority of the locations will be sampled with core tubes approximately 4 ft. long. Deeper sediments will be sampled with core tubes custom cut on the boat from 10 ft tube sections.

6. Mount a clean coring tube onto the vibracoring device, using extension tubes, as necessary.

7. Lower the coring apparatus with the core tube attached vertically through the water column tube end first, until the river bottom is reached.

8. Gently push the core tube into the river bottom while maintaining the apparatus in a vertical position.

9. Attach the vibracoring apparatus to the aluminum extension tube and vibrate the core into the sediment to refusal. Measure and record the depth of core tube penetration into the sediments in the field database.

10. Pull the apparatus upward out of the river bottom (using a winch as needed), and raise it to the surface, while maintaining the core in a vertical position.

11. Before the bottom of the tube breaks the water surface, place a cap over the bottom to prevent the loss of material from the corer. If boats are properly equipped (i.e., can provide safe access for personnel to reach the water), the cap will be placed on the core by reaching down into the water from the sample vessel, otherwise a second boat may be needed. Secure the cap in place with duct tape when brought on board the vessel.

12. Water overlying the core tube in the coring apparatus will be allowed to drain prior to removal of the core tube.

13. Estimate the recovered length of the sediment core and note it in the electronic field database.

    - The length of the cores recovered in Lexan® tubing will be determined by direct measurement.
    - The length of the cores recovered in aluminum tubing will be determined indirectly by tapping the core with a metal rod from the top to the bottom. The spot where the pitch of the sound changes corresponds to the approximate top of the recovered core.

    The distance between the top of the sediment in the core tube and the bottom of the coring tube corresponds to the estimated length of the recovered core.

14. Compare the length of the recovered core with the core penetration depth.

- If the recovered length of the sediment core is more than 60% of the penetration depth, keep the core.
- If insufficient amount of material is recovered, discard the core into a re-sealable 5-gallon pail and store for subsequent disposal as PCB-waste at the field processing facility. Rinse the core tube with river water and prepare to make an additional attempt.
    - An additional attempt will be made at a minimum distance of 1ft from previously attempted locations.
    - A maximum of three attempts to collect a core will be made for a given location ID.
    - Rinse the core tubes with river water between consecutive attempts.
    - If all three attempts to collect a core are unsuccessful based on recovery alone (i.e., less than 60% recovery), retain the final core for analysis and put flag in the database that indicates that the targeted recovery was not achieved.
    - If an acceptable core cannot be collected within 10 ft of the node location, abandon the location and note conditions preventing core collection in the field database.

15. After a successful core recovery enter additional information into the field database:
    - Date
    - Time of recovery
    - Actual coordinates of the sample location
    - Water depth (ft)
    - Core tube material (aluminum or Lexan®)
    - Core penetration depth (in)
    - Observations, including probing results

16. Remove the core tube from the extension tube and place a second cap on the top of the core tube. Secure the cap in place with duct tape. Rinse the outside of the core tube with a small amount of river water.

17. Draw an arrow on the core tube with permanent marker to mark the top of the core. Label the core with permanent marker indicating station ID, date, and time.

18. Store the core vertically in a core tube rack on ice. Use a tarp to keep the cores in the dark until they are transported to the field processing facility.

19. At locations where core samples cannot be collected and grab samples will be collected by lowering a ponar dredge until it comes in contact with the sediment and the release mechanism trips. Retrieve the ponar dredge and empty the contents into a new aluminum pan. Seal container with lid and duct tape. Label the container with permanent marker indicating station

ID, date, and location. Place aluminum pan on ice in a cooler.

20. Decontaminate the ponar dredge according to the following decontamination procedure:

- Wash with laboratory grade detergent
- Rinse with distilled water
- Rinse with acetone and allow to air dry
- Rinse with hexane and allow to air dry
- Rinse with distilled water and air dry
- Contain rinsate for disposal at the field processing laboratory

20. At the end of each day, an electronic copy (disk) of the field log that includes the information recorded for each core sample collected that day will be provided to the processing laboratory coordinator. Additionally, a hard copy of the field log will be printed out. The hard copy will serve as a back-up to the electronic copy, as well as the chain of custody form from the field to the processing laboratory. This form will be signed by sample collection personnel and core processing personnel at the time that the core processing personnel take custody of the cores. A copy of the signed field log form will be maintained in the processing laboratory.

APPENDIX 2

(The attached SOP includes Attachment A: *Ocean Surveys, Inc. Manual of Standard Operating Procedures.* This attachment contains SOPs for the operation and calibration of navigational and geophysical survey instrumentation. Not all of the SOPs included in this attachment apply to the Bathymetric Survey SOP.)

STANDARD OPERATING PROCEDURE FOR BATHYMETRIC SURVEYS (in the Land Cut)

1. Bathymetric (hydrographic) survey activities will occur over a one day period in the "Land Cut" section of the Champlain Canal that runs outside of the river between the Fort Miller Dam (Lock 6) and Thompson Island Dam - HRM 186 to 189. Since this is a well traveled navigational channel, the work will be coordinated with the Canal Corporation, as required by the Health and Safety Plan and the Community Health and Safety Plan. In addition, the sampling vessels will maintain contact with the Canal Corporation using marine band channel 13.

2. The bathymetric survey will utilize GPS receivers (Trimble 7400 MSi) to acquire navigation data using shore-based reference stations with known coordinates and elevations. Differential correctors determined at these stations will be transmitted to the survey vessel where they will be used by the onboard receiver using Real Time Kinematic OTF software to determine the accurate position of the GPS antenna in the vertical and horizontal planes. These data will be logged on board at one-second intervals for the duration of the survey. Data quality parameters will also be logged and monitored by the onboard navigator with flags put on all data points which do not meet the quality limits set. The specified accuracy for this system is +/- 2 cm when satellite configuration is sufficient.

3. Before leaving dock, the hydrographic crew will check to make sure all navigation and instrument systems are working properly. Calibrate and set navigation instruments based on the instrument-specific standard operating procedures (Attachment A). Prepare survey

equipment for start of daily survey operations including: deployment of 200 kHz transducer into water, measurement of survey equipment offsets, daily speed of sound test (bar check), and other required pre-survey activities.

4. Navigate through the lock to the coordinates of the first transect in the Land Cut. As this is a narrow navigational channel, each transect will run parallel to the canal bank. Approximately 4 longitudinal transects will be surveyed to establish bank-to-bank depth information in the Land Cut. A Coastal Oceanographics "Hypack Max" will be used for trackline design, navigation, trackline control, and digital depth and RTK DGPS data logging.

5. Align survey vessel along transect and confirm heading and equipment operation. Start data acquisition and commence hydrographic survey along transect. Conduct the bathymetric survey using an Innerspace 448 digital depth sounder with a 200 kHz towfish. The average distance between depth soundings should be approximately 2 feet. Log the depth data to the Hypack Max system.

6. Note relevant observations and changes in operational procedures to the field log. These may include: coordinates of observed obstructions or artifacts; areas where interferences or other conditions limit survey resolution or prevent bank-to-bank coverage; and coordinates where adjustments to tow fish height, line spacing, or range scale are made.

7. At the end of each transect, confirm successful data acquisition and storage, navigation and equipment calibrations and settings. Log time and coordinates at end of each transect line surveyed.

8. Prepare equipment for navigation to next transect; navigate to next transect.

9. Repeat steps 4-8 for collecting data along a transect until bank-to-bank coverage has been achieved in each survey section. Maintain a safe operating distance (as determined by boat operator) from lock gates between transects.

10. At the end of each day, backup daily computer data and check for error flags.

11. Output all notes and electronic target files to an ASCII file and store with the raw records.

12. All raw survey data and information (e.g., field notes, instrumentation frequencies) must be documented electronically or in a field notebook. Back-up copies of raw electronic data and copies of field logbooks will be made at the end of each survey day.

ATTACHMENT A

OCEAN SURVEYS, INC.
MANUAL OF
STANDARD OPERATING PROCEDURES

(Geophysical Survey Instruments)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

1.0 INITIAL EQUIPMENT SETUP

This is a draft document. The most recent modification was on 07/31/02 by MLK. New versions will be distributed as they are created.

There are presently several documents that are associated with this that are not included at this time.

1 Caris offset drawing
2 Hypack offset drawing
3 System wiring document
4 System comm. Port settings and data formats

1.1 General Tasks Before Start of Survey

- Notify GE of vessel movement
- Obtain permits for movement through and between locks
- Obtain proper charts and update with all Notice to Mariners
- Verify availability of CG DGPS correctors and RTK stations
- Document equipment installation
    - Establish Boat 0,0,0
        - Vessel fore/aft centerline, aft edge of athwart ship I-Beam on A-Frame, point on aft deck slightly above waterline
    - Measure and record all offsets
        - Trimble 7400 MSi DGPS's
            - Navigation antenna X, Y, Z
            - Reference antenna X, Y, Z
        - Trimble 7400 RTK GPS
            - Antenna to waterline
            - X & Y to boat 0,0
        - Innerspace 448 X, Y, Z
        - TSS DMS 2i-05
            - X, Y, Z
            - Zero out mounting angles with appropriate vessel loading – see procedure in TSS section
        - Robertson Compass
            - X, Y

- Align to true heading of vessel centerline – see procedure in Compass section

- Sidescan Tow Point X, Y, - Z left at 0.0 m for proper Caris import of layback

- Subbottom Profiler Tow Point X, Y, - Z left at 0.0 m for proper Hypack import of layback

1.2 Equipment Setup

1.2.1 Trimble 7400 Receiver

- Initial Settings
  - RTCM Output = off
  - RTCM Input
    - Inputs ON
    - Port = 2
    - Format = USCG
    - ASCII Printout off
    - Beeper Off
    - Station = any
    - Age Limit 20 sec.
    - Integrity Monitor Off
  - Power Up Control
    - Do not default controls at power up
  - SV Enable/Disable
    - Disabled mode = none
  - Adjust local time
    - Time offset EDT-UTC = -4 hrs
    - Time Zone Identifier = EDT
  - Baud Rate Format
    - Port 1 = 9600-N-8-1
    - Port 2 = 9600-N-8-1
  - Remote Protocol
    - Data Collector Compatible
  - Reference Position
    - Lat = 35 50 40.91718
    - Lon = 075 39 19.57021
    - Height = -37.529

        - (Note, may be changed during survey by selecting **HERE** to get local position and current ellipsoid height for Lat/Lon – Fixed height)
      - Masks/Sync Time
        - Elevation Mask = 8
        - PDOP Mask = 5
        - SV Sync Time = 1.0
      - Positioning Modes
        - Weighted solution enabled
      - Lat/Lon Height Always
  - Power Controls
    - Charger and Power output disabled
  - NMEA 183 Output
    - Port 1 Enabled
      - GGA, VTG, ZDA
  - Cycle Printouts = Off
  - 1 pps output = disabled
  - Default controls – **DO NOT USE!!! RESETS TO FACTORY**
  - Modify
    - Units of Measure
      - Lat/Lon Degrees = Deg.Min.Sec.
      - Time = 24 Hr UTC
      - Position = WGS-84 LLH
    - Altitude Reference
      - Height above ellipsoid

1.2.2 MX-51 Beacon Receivers

- Initial Settings - DGPS1

  - **HUDSON FALLS, NY**
    Status: Operational
    RBn Antenna Location: 43° 16.21' N73° 32.31' W
    REFSTA Ant Location (A): 43° 16.2491' N73° 32.34705' W
    REFSTA Ant Location (B): 43° 16.2637' N73° 32.34534' W
    REFSTA RTCM SC-104 ID (A): 94
    REFSTA RTCM SC-104 ID (B): 95
    REFSTA FIRMWARE VERSION: RD00-1C19
    Broadcast Site ID: 844
    Transmission Frequency: 324 KHZ
    Transmission Rate: 200 BPS
    Signal Strength: 100uV/m at 135NM

- CTToolbox should be used to reload H11032R.CNF (config file) if necessary. The following settings are in H11032R.CNF
    - CONTROL/BASE STATION
        - Input using **HERE** at Hudson Falls
        - LAT 35 50 40.77420
        - LON 075 39 19.81768
        - HGT – 0035.870
        - ANT Height 000.000
    - CONTROL/SV ENABLE/DISABLE
        - ALL – ENABLE
    - CONTROL/GENERAL CONTROLS
        - ELEV. MASK: 08
        - PDOP MASK : 05
        - MEAS RATE 1 HZ
        - MOTION: KINEMATIC
    - CONTROL/POWER CHARGER
        - POWER OUTPUT MODE DISABLED
    - CONTROL 1PPS OUTPUT
        - 1 PPS OFF
        - ASCII TIME TAG PORT OFF
    - CONTROL SERIAL PORT OUTPUT
        - NMEA/ASCII OUTPUT
        - GGK
            - PORT 2
            - 1 HZ
        - ZDA
            - PORT 2
            - 1 HZ
        - All others off
    - STREAMED OUTPUT
        - ALL OFF
    - RT17/BINARY OUTPUT
        - ALL OFF
    - CMR/RTCM
        - BASE – MOVING
        - CMR PORT – OFF
        - NAME - cref
        - RTCM PORT – OFF
        - TYPE - 1
    - CONTROL/SERIAL PORT SETUP
        - PORT1 9600 8-NONE-1
        - PORT 2 9600 8-NONE-1 NONE

- PORT 3 9600 8-NONE-1
- PORT 4 9600 8-NONE-1 NONE
- CONTROL/INPUT SETUP
  - USE RTCM STATION – ANY
  - RTK/DGPS AUTO SWITCH RANGE – 20.0 KM

1.2.3 Compass

- Initial Calibration Procedure
  - Load vessel, as it will be for survey ops. Remove any large ferrous objects from the vicinity of the compass.
  - Position the vessel in open water
  - Apply power to the Robertson autopilot
  - Begin by turning the vessel to starboard.
  - Select **INSTALLATION/RFC COMP calibration**.
  - Calibration should complete after ~ 1 ¼ turns and should be verified by a display of **Calibration confirmed**.
- Determine and apply Compass Offset
  - Con the vessel on a straight line while observing the heading computed by the GPS system.
  - Adjust the offset by turning the autopilot knob to match the pilot compass heading to the gps heading. Note the applied offset. (This puts the pilot compass into "TRUE" heading.)

1.2.4 TSS DMS 2i-05

- Initial Settings
  - Set baud rate/format to 19200,N, 8,1
  - Heave bandwidth = SHORT
  - Output Rate = 50 hz.
  - GPS data input settings = NMEA Local 9600, 8, N, 1
    - Check GPS RAW and CALCULATED input
  - GYRO data input settings = NMEA Local 4800, 8, N, 1
    - Check Compass RAW & CALCULATED INPUTS
  - Data output format = TSS1 19200, 8, N, 1
  - Zero out mounting angles. Document mounting angles with screen grab.
    - Stabilize vessel with static loads approximating those that will be experienced during the survey.
    - Access TSS through communication program and set mount angles automatically by averaging data for 5 minutes
    - Accept values and screen grab settings

Restart TSS operation and exit from program

Mount Angle Setting Recorded
06/04/02

```
---------------------------------
DMS 2-05 Version 2.03 Terminal Mode
---------------------------------
Sensor Mounting

Orientation : Vertical
Roll  Mount Angle [  1.741  deg] :
Pitch Mount Angle [  1.711  deg] :
Yaw Mount Angle [  0.000  deg] :
```

- **Do Not Change These Settings!**

•

1.2.5 Innerspace 448

- Initial Settings
  - Verify the following initial settings
    - Gain = Approx. 10 o'clock setting
    - Range = 0-15 M
    - Mode = Meters
    - Chart Speed = 4
    - Range Multiplier = X1
    - Input default speed of sound of 1500 m/s
    - Set draft = 0.0
    - Tide = 0
    - Initial = 5
    - Gate = 2
    - Mode = Gated
    - Reply = 16
    - Alarm on during survey
    - Set variable power TX board to Low, to limit interference with SS and MB
    - Set internal TVG curve switch to open/open or +60 db. This was needed to receive quality data at the above mentioned low power setting with our combination of components
    - Set date & time – See back of paper carrier
    - Load paper per picture on back of paper door
      -

1.2.6 Klein 595

- Initial Recorder Setup

- Set system to factory defaults by pushing left button on the CPU board
    - This resets all values to factory default
    - It also resets all gain curves and other "adaptive controls prior to calibration
        - A calibration should be preformed, per the manuals description any time a component is changed, like a cable or fish
  - Set time/date in submenu
    - Add "*" to time and date to print it when an event is pressed. This can be used to log tuning changes and rub tests
  - Set system to the following values:
    - Auto CPU
        - Altitude = 0,0
        - Return = 0
        - Offset = 2
    - Auto TVG Port
        - Normal
        - Atten. = 9
        - Salt Water
    - Auto TVG Starboard
        - Normal
        - Atten = 9
        - Salt water
    - Printer = Off
    - Range = 25 Add "*" to field
    - Scale lines = 10 Add "*" to field
    - Source = Fish
    - Channel = 1 | 2
    - Speed = Manual –1.0 Set to avoid alarms
    - Altitude = Auto
    - Mapping Mode = Off
    - Altitude Alarm = Off
    - Auto Mark = Off
    - Event Count = Off
    - Event Mark = Off
    - Side Scan Expand = Off
    - Profiler Expand = Off
    - Nav Source = Nav3* - used for external Eventing option

- Follow the calibration found in the operations manual on 3-34 to tune for site conditions
- Document tune-up settings in SSS annotations
- Document tow configuration and Cable out in SSS annotations
    - Tow Point
        - See attached drawing for exact location
        - The tow point is a sheave mounted to a bowsprit. In operation the fish is lowered to1meter in the water as the vessel is moving at survey speed.
        - The cable is fair leaded back to the stern on the outside of the bowsprit mount. Cable out measurement is taken from the point of the sheave closest to the mount point
        - The layback was measured by observing the fish under survey conditions and measuring from the center of the xducers to the tow point.
        - Document any changes made to the recorder online in the Isis notes section
- Initial Fish Setup
    - Depression angle = 20 degree's
    - 500 KHz only
    - 100 KHz disabled in fish – SCR trigger is disconnected.
    - Attach depressor to fish

- Internal Jumpers
    - A/D board jumpers should be set to reflect proper software version (checked 050202)
    - Fish Tape I/O jumper should be set to either 15v for short cable or 24v for long cable (winch) (checked 05/2/02 set to 15v)
    - Verify which channel is tracking altitude on the Connector interface board

1.2.7 Bar Check

- Initial Setup and Calibration
    - Determine maximum depth of survey and depth units
        - Sheet A maximum depth is in the 10 meter range
        - Survey depth units are meters
    - Construct Bar Check per OSI standards
    - Type 1
        - .2 meter diameter lead disk with eye bolt
        - Imprint a "serial number" onto bar
            - "A"

        - "B"
    - Coated aircraft cable
    - Brass marker beads at appropriate intervals
        - Minimum of every 1 meter throughout the survey depths
        - This is to allow use of a "pocket rod" to read inter bead values
    - Also mark cable on both sides of bead with a "sharpie" to help identify bead slips
    - Measure bead locations with steel tape to the nearest 0.01 meter increment
    - Record bar s/n and all other information required on OSI Lead Line Calibration form
  - Recalibration
    - Recalibrate Bar Check every 6 months, or after any action that could possibly affect the condition of the Bar Check, such as snagging line on bottom.
    - Recalibrate at the completion of the survey
  - Maintenance
    - Periodically examine the eye bolts and cables

- Type II
    - Aluminum square-beam > width of boat with target at position of in hull xducer
    - Imprint a "serial number" onto bar
    - Coated aircraft cable
    - Brass marker beads at appropriate intervals
    - Minimum of every 1 meter throughout the survey depths
        - This is to allow use of a "pocket rod" to read inter bead values
    - Also mark cable on both sides of bead with a "sharpie" to help identify bead slips
    - Measure bead locations with steel tape to the nearest 0.01 meter increment
    - Record bar s/n and all other information required on OSI Lead Line Calibration form
  - Recalibration
    - Recalibrate Bar Check every 6 months, or after any action that could possibly affect the condition of the Bar Check, such as snagging line on bottom.
    - Recalibrate at the completion of the survey
  - Maintenance

- Periodically examine the eye bolts and cables

1.2.8 GE 1 Computer System

- Start Up
  - Verify DC Mains and Autopilot are off before powering up, or logging onto, system
  - Log on using default Logon
    - User Name osiuser
    - Password (blank)
- Verify time zone is set to (GMT) Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London.
- DO NOT CHECK "Automatically adjust clock for daylight savings time.

- Start HyPack MAX with appropriate shortcut
  - Open new project named GE-1
    - Create folders in the project folder named DATA1
    - Set geodesy to UTM Zone 18 WGS 84
    - HYPACK HARDWARE SETUP
      - New File
      - NAV - NMEA183.DLL
        - Name = DGPS1
        - Update Frequency = 50ms
        - Type
          - Position
        - Options
          - Record raw data
          - Record quality data
        - Record
          - Always
        - Connect
          - Serial Port
            - COM3, 9600,8,none, 1,Flow Control = none
        - Offsets
          - Starboard = -.35
          - Forward = + .23
          - Height = +1.97
          - Latency = 0.860
        - Setup
          - Standard NMEA 0183 sentences to be used

            - GGA
        - HDOP Limit = 2.5
        - Minimum Satellites = 4
        - Use ZDA message for time tag = Disabled
        - Send alarm when non differential
- Depth – Innerspace 448 {Serial} - IN448.DLL
    - Name = 448
    - Update Frequency = 50
    - Type
        - Echo sounder
    - Options
        - Record raw data
        - Record quality data
        - Paper Annotation
    - Record
        - Always
    - Connect
        - Serial Port
            - COM6, 9600,8,none, 1
    - Offsets
        - Starboard = 0.0
        - Forward = 0.0
        - Height = +.8 NOTE!!! .8 meters used as "display offset". See Draft explanation
        - Latency = 0.000
    - Setup
        - Send annotation string with event mark
        - Multiply not needed
- Auto Pilot Compass – NMEA.DLL
    - Name = AP Compass
    - Update Frequency = 50
    - Type
        - Heading
    - Options
        - Record raw data
        - Record quality data
    - Record
        - Always
    - Connect
        - Serial Port
            - COM5, 4800,8,none, 1

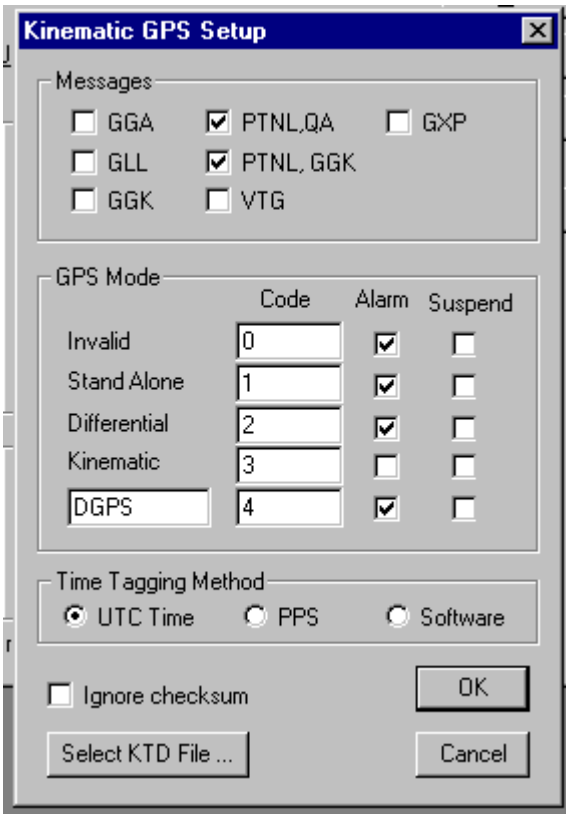
    - Offsets
        - All zero
    - Setup
        - Sentence to be used
- HDG
- Auto Pilot – NMEA.DLL
    - Name = AP XTE
    - Update Frequency = 500
    - Type
        - Output
    - Options
        - Record raw data
        - Record quality data
    - Record
        - Always
    - Connect
        - Serial Port
            - COM8, 4800,8,none, 1
    - Offsets
        - All zero
    - Setup
        - Sentence to be used
- GGA
    - Sentence to generate
    - APB
    - GLL output places = 4
    - XTE (Nautical Miles) checked
    - Output to hundredth decimal place = Enabled
    - XTE Factor = 0.0

- File Server – Delph Output – DELPH.DLL
    - Name = Isis Out
    - Update Frequency = 20000
    - Type
        - (nothing checked)
    - Options
        - Record raw data
        - Record quality data
        - Paper Annotation
    - Record
        - Always
    - Connect
        - Serial Port

        - COM7, 9600,8,none, 1
    - Offsets
        - All Zero

- TSS DMS2i-05 – TSS320.DLL
    - Name = DMS2i-05
    - Update Frequency = 50
    - Type
        - Heave Compensator
        - Other
    - Options
        - Record raw data
        - Record quality data
        - Paper Annotation
    - Setup
        - Motion reference Unit Only
    - Connect
        - COM 1 19200,8,N, 1
    - Record
        - Always
    - Offsets
        - Position
        - Starboard = -.44
        - Forward = +.47
        - Vertical = -.18
        - Yaw = 0
        - Pitch = 0
        - Roll =0
        - Latency =0

- Trimble 7400 RTK OTF - KINEMATIC1.DLL
    - Name – RTK
    - Type
        - Position
        - Echosounder
        - Sync. Clock
        - Tide Gauge
    - Record RAW
    - Record Quality
    - Setup



- SELECT KTD FILE
  - File 02ES007.KTD used for survey ops

- Connect
  - COM2 9600,8,N, 1, Flow Control = none
- Offsets
  - Position
  - Starboard = -1.50
  - Forward = +.25
  - Vertical = + 2.05
  - Yaw = 0
  - Pitch = 0
  - Roll =0
  - Latency =0
- Record
  - Always

- Create a second mobile named RTK. Transfer the RTK device to the second mobile

- URS-1 – VHW.DLL
  - Name = Speedlog
  - Update Frequency = 200
  - Type
    - Speed
    - Other
  - Options
    - Record raw data
    - Record quality data
  - Setup
    - none
  - Connect
    - COM 9 4800,8,N, 1, Flow Control = none
  - Record
    - Always
  - Offsets
    - None
- Settlement – DraftTable.dll
  - Name = Settlement
  - Update frequency = 100
  - Type
    - Draft
  - Setup
    - Create Draft table from Settlement and Squat test
    - Insert Draft table picture – set to 0.0 for squat test
  - Offsets
    - None
  - Connect
    - Ignored
  - Record
    - Always

1.2.9 GE-1 CARRIS OFFSETS to BOAT

DGPS1 (NMEA183.DLL)

STBD	+1.18
FWD	+0.02
Height	+1.97
Latency	+0.00

448 (INN448.DLL)

STBD	+1.53

FWD	-0.21
Height	+0.80
Latency	+0.00

Auto Pilot Compass (NEMA.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

Isis Output (DELPH.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

Auto Pilot (NEMA.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

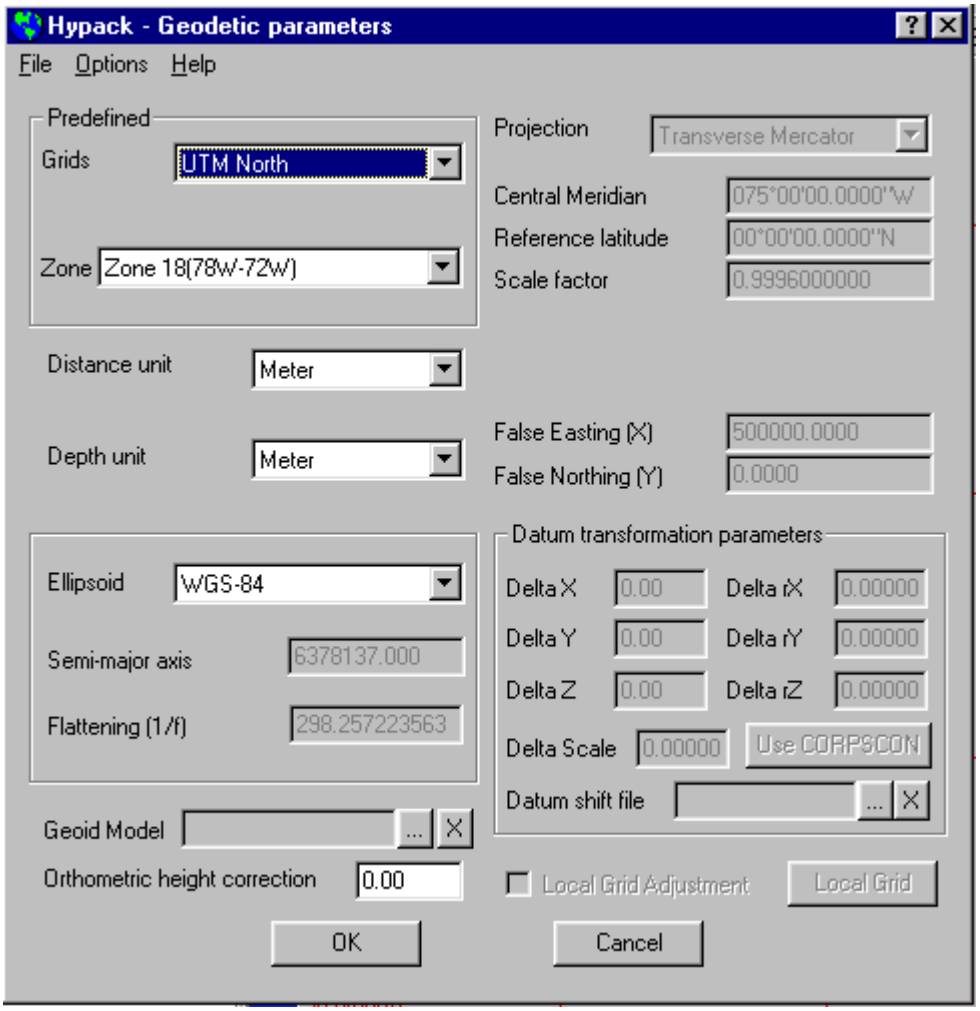
DMS 2i-05 (TSS 320.DLL)

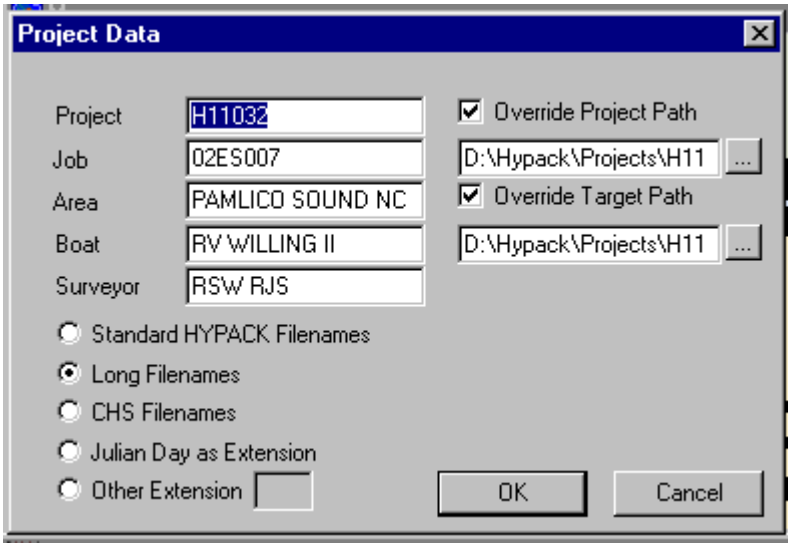
STBD	+1.09
FWD	+0.26
Height	-0.18
Latency	+0.00

RTK GPS_KINEMATIC.DLL

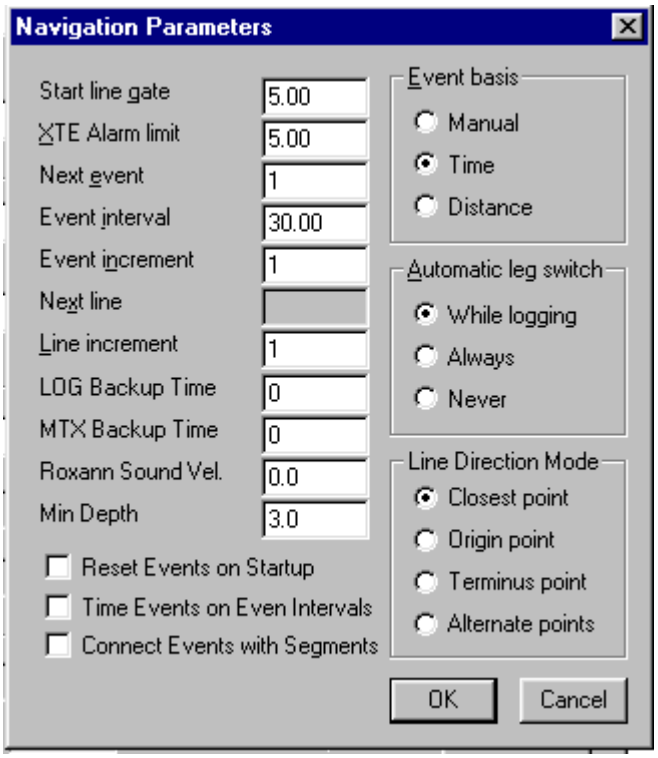
STBD	+0.03
FWD	+0.02
Height	+2.05
Latency	+0.00

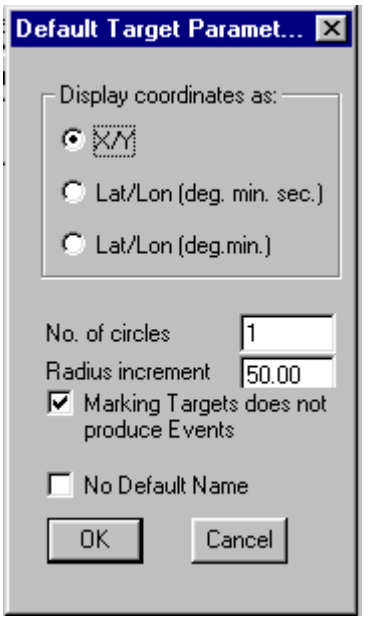
1.2.10 Other Hypack Max Settings


Hypack - Geodetic parameters
File Options Help
Predefined
Grids
UTM North
Zone
Zone 18(78W-72W)
Projection
Transverse Mercator
Central Meridian
075°00'00.0000"W
Reference latitude
00°00'00.0000"N
Scale factor
0.9996000000
Distance unit
Meter
Depth unit
Meter
False Easting (X)
500000.0000
False Northing (Y)
0.0000
Ellipsoid
WGS-84
Semi-major axis
6378137.000
Flattening (1/f)
298.257223563
Datum transformation parameters
Delta X
0.00
Delta rX
0.00000
Delta Y
0.00
Delta rY
0.00000
Delta Z
0.00
Delta rZ
0.00000
Delta Scale
0.00000
Use CORPSCON
Datum shift file
Geoid Model
Orthometric height correction
0.00
Local Grid Adjustment
Local Grid
OK
Cancel


Project Data
Project
H11032
Job
02ES007
Area
PAMLICO SOUND NC
Boat
RV WILLING II
Surveyor
RSW RJS
Override Project Path
D:\Hypack\Projects\H11
Override Target Path
D:\Hypack\Projects\H11
Standard HYPACK Filenames
Long Filenames
CHS Filenames
Julian Day as Extension
Other Extension
OK
Cancel

NOTE: XTE ALARM set to 100000 for Sea Trials





- **1.2.11 ISIS**

o Start Up

- Verify DC Mains and Autopilot are off before powering up, or logging onto, system. Note: if monitor does not come on (yellow power/signal indicator steady yellow on lower right corner of monitor) remove power from monitor for a few seconds, then restore and turn on monitor.

- Start Isis with Isis H11032 shortcut – **Only**
  - This calls up a specific configuration file

- File types and locations
  - H11032 ISIS Short Cut to Start Isis Desktop
  - H11032.LAY Window Layout E:\H11032 ISIS\H11032 Config\
  - H11032_140.CFG Isis configuration file D:\TEI\IsisSona\v5.91\
  - Survey. log Isis session log D:\root
    - Note: unable to redirect this file

- Initial Processor Settings
  - File Menu
    - Playback N/A
    - Record Setup
      - Sonar Setup
        - Pick standard analog
        - Select CHICO/CHICO PLUS Board
          - Channel 1 edit
            - Status = On
            - Name = Port
            - Type = Port SSS
            - Trigger = 1
          - Channel 2 edit
            - Status = On
            - Name = Stbd
            - Type = Starboard SSS
            - Trigger = 1
          - All other channels disabled
          - Sonar name to H11032 Klein 595 2 CH 500Khz
          - Frequency = 384.0,384.0
          - Horizontal Beam Angle = 0.2,0.2
          - Beam Width = 50.0, 50.0
          - Tilt angle = 20.0, 20.0
          - Name of server = ISISCHICO.EXE
          - Automatic control disabled
      - Serial Port 1 Heave, Pitch, Roll
        - Status = On

- Settings = 19200, 8, N, 1
- Template = TSS
- Convert Lat - Long = Disabled
- Filter Speed = Disabled
- Navigation Latency = 0.0

- Serial Port 2 Not used
- Serial Port 3 GPS for SSS
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = NMEA0183 NOCLOCK
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 4 GPS for Single Beam
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = NMEA0183
    - NMEA0183 SHIPPOS NOVTG
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 5 Compass
  - Status = On
  - Settings = 4800, 8, N, 1
  - Template = NMEA0183 NOCLOCK NORMC NOGLL NOVTG
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 6 May be used for Fish Altitude input
  - Better Tuning Has Made This Option Unused
    - Manual SSS Bottom Tracking Option
  - Status = Off
  - Settings = 9600 8, N, 1
  - Template = Manual
    - Modify Default = {/100}{-1.3}7
      - Change 1.3 to value needed to get correct altitude
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0

- Serial Port 7 Hypack feed for Line Control
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = (Leave Blank)
    - Allows events and start/stop info in from Hypack
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 8 448 feed to Aux Sensor 1
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = Manual
    - Modify Default = {/100}1
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
  - Serial Port 9 RTK INPUT
- Serial Port 10 Speed Log
  - Status = On
  - Settings = 4800, 8, N, 1
  - Template = {pattern=m}s
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0

- File Format
  - Format = XTF
  - Media = Disable
  - Sample Size to Record = 16 bit
  - Samples per Channel = 1024
  - Processing Method = MAX
  - XTF File Header Notes
    - Vessel Name
    - Survey Area
    - Operator

- Configure
  - Playback Speed – as desired
    - Real Time Scrolling
      - Scroll without restoring covered data
        - This keeps system from locking up
    - Transducer Depth = 0.0
    - Ocean Tide

        - Apply Corrector = Disabled
        - Verify = 0.0
    - Sound Velocity = Average from first cast of the day
    - Multiple Pings = 1
    - Hypack DDE
        - Accept from Hypack = Disable All
        - Automatically Start Saving At Start of Line
            - Use File Name from Hypack = Enable
            - Generate File Names = Disable
            - Start Each File with = Enter Daily Directory Info
    - Cue Boxed = Disabled
    - Set Date and Time = Ignore – Will be automatically set during operation
    - Save Setup = Prompt User at Exit

- Color
    - Palette
        - SSS Colors = Grey Scale
        - Squelch = 0.0
        - Reverse Palette = Enabled
        - Strong Returns Red = Disabled
    - Grid Color
        - Voltage Grid
            - Line = Blue
            - Data = White
            - Dim = Both Enabled
        - Scale Lines Red

- View
    - Scale Lines
        - Apply Settings to = All the same
        - Scale line Unit = Distance
            - Spacing = 10
    - Depth Delay and Duration
        - Apply Settings to = All the same
        - Units = Off
    - Overlay
        - Show on Waterfall
            - Event Marks = Disabled
            - Event Text = Disabled
            - Bottom Track = Enable
        - Bookmarks

- Save Bookmarks = Enabled
- Display Bookmarks = Enabled

- Down Sample = Max
- Speed
  - Automatic = Enabled
  - Filter = Disabled
- Heading = Automatic
- Layback Correction
  - Apply Delta XY = Disabled
  - Apply Layback = Enable
    - Use Logged Layback = Disabled
    - Enter layback manually = Enabled
    - Compute layback from Cable Out = Disabled
    - Enter layback value in box provided (Currently 1.0M)
      - This field with be empty, enter value
        - Obtain value from chart
      - Click ACCEPT, current value changes to entry
      - NOTE: **DO NOT CLOSE WINDOW**
      - NOTE: CHECK AT START OF EACH LINE
      - NOTE: HAVE OPEN DURING CONTACT PICKING

- Tools
  - Target Setup
    - TargetPro.exe only
  - Target Setup
    - Height = 512
    - Width = 2048
    -
  - Target
    - File
      - **Set working Directory = Enter Daily Data Directory**
    - Tools
      - Configuration
      - Speed auto
      - Speed Corrected display = yes
      - Layback = manual
      - Horizontal beamwidth
        - Manual, 0.0
      - Local variation = 0.00
      - Latitude/longtitude
        - Deg Min Sec

        - Northing/Easting Display
            - Meters
        - Range Display Units
            - Meters
        - Speed display Units
            - Knots
        - Misc.
            - Automatic Audit Trail = yes
            - Object Detection on image load
                - None
    - Units = Meters
    - Constants = Use defaults
    - Set Contact Number = Start with 1 – Ensure number is consistent with contacts logged to date.
    - Speed Correct = Enabled

- Parameter Window – Current File Section
    - Switch Button
        - Record Data to File Name = Blank
        - Remaining storage = Enable D: and E:
        - File Grows larger than = Disable

Altitude - Absolute

Based on 595 Range Scale

Range	8% Minimum Altitude	20% Maximum Altitude
25	2.00	5.00

Maximum System Speed

Based on 595 Ping Rate

Range	Ping Rate / Second (Measured)	Maximum Speed (Knots)
25	27.00	17.50

Maximum Survey Speed

Based on 10% Buffer

Range	Maximum Speed (Knots)	90 %Maximum Speed (Knots)
25	17.50	15.75

- **1.2.12 Robertson Autopilot**

Introduction:
The factory technical representative for the parent company Simrad, is Rich Barnes (425-778-8821) who is located at Simrad, Inc., 19210 33rd Avenue West, Suite A, Lynwood, WA. 98036. The pilot was interfaced to NOAA1 to receive NMEA (modified) standard messages from Coastal Oceanographics HYPACK MAX Survey program. The vessel captain performs all operations related to the pilot.

Interface:
The pilot receives the following NMEA-0183 messages;
APB (modified by Coastal to send .#### nm of cross track error vs. .## nm, the NMEA standard)
VTG (standard)
GGA (standard)
Baud rate is 4800/N/8/1
NMEA input to the pilot is through TB 10 on the Junction Unit, Pins RX 1(+) and RX1 (-). There is no handshaking or error correction used. The Robertson RFC35R rate compass is used to provide vessel heading to all systems and outputs a NMEA message through TB10on the Junction Unit, Pins TX2(+) and TX2(-).

Operation:
The pilot starts in the **Helmsman** mode. The captain steers the vessel on to the trackline well ahead of the actual BOL and attempts to track down the line. When the vessel has stabilized online the pilot is put into the **Auto** mode. The pilot is "course steering" at this point. The captain observes the vessel motion and line tracking while adjusting the "course" using the left/right buttons on the control unit or remote control. When the vessel is steering the line and cross-track error has been reduced to a minimum (typically less than 1 meter), the captain changes to the **NAV** mode. The pilot will continue to steer in "course steering" mode for a period of time determined by an internal setting (currently at minimum – 100 sec). Then it will use the XTE value received from HYPACK MAX and attempt to adjust it's course to achieve zero XTE.

Some conditions prohibit the use of the **NAV** mode. One example is the use of a drogue chute to slow the vessel. Sea conditions that cause sudden large heading changes are another example. In these cases the pilot is left in the **Auto** mode and the left/right buttons on the control unit or remote control unit are used to con the vessel down the line.

Initial Setup:

Mechanical setup and alignment are performed at the time of installation and should require no further adjustment. There are many electronic settings that affect pilot operation. They fall in to several categories:

- Front Panel
    - Rudder – used to set the amount of rudder used by steering commands
    - Counter Rudder – used to set the opposing rudder used when crossing a course line
    - Weather – used to reduce pilot sensitivity in heavy seas
- Info Loop
- Weather Loop
- Debug Loop

Normally, only the Rudder setting is changed throughout the day. More rudder (higher #) causes closer tracking and quicker steering response. Too much rudder causes large heading swings. Too little rudder and the vessel will fail to closely follow the line.

2.0 PRE SURVEY OPERATIONS

2.1 Navigation System Check

Upon arrival in Hudson Falls a third order control disk will be located to facilitate the performance of a navigation confidence test. Two separate procedures will be performed. The first procedure is to determine the horizontal and vertical position of the project RTK GPS base station and certify it. The second procedure involves using the Trimble 7400Msi L!/L2 Kinematic OTF system to locate a check point in proximity of the survey vessel for future confidence checks.

The first procedure involves the following.

A RTK base will be set up with it's antenna positioned at a known height over a GE/QEA supplied point. The Trimble 7400Msi reference receiver is then configured to provide CMR correctors based on the following parameters.

Configuration Toolbox file D24_Base.cfg

1. Generate CMR correctors on Port 1
2. Kinematic base unit
3. A elevation mask of 13 degree's
4. A PDOP mask of 5
5. Reference position of 35 50 40.87561 Lat, 075 39 15.38597 Long, -37.75 Elev. (WGS-84 Ellipsoid height)
6. Antenna height set to 2.000 meters, Antenna mounted on a 2.00 meter rod
7. Antenna type set to L1/L2 compact resulting in a True Vertical Height of 2.062 meters

The project RTK base will be set up as a rover station, receiving corrections from the station set at various stations using the following parameters:

Configuration Toolbox file RTK_ROV.cfg

1. Receive CMR corrections on Port 1
2. Kinematic rover
3. A elevation mask of 13 degree's
4. A PDOP mask of 5
5. Output GGK on Port 2.

For reference, the RTCM-104 correctors will be relayed from the reference station to the project base station location with Pacific Crest Radio Modems Model RFM96W.

Finally, a Hypack Project will be setup to monitor the position in both WGS-84 Lat, Long and UTM Zone 18 NAD-83. The following parameters will be used.

1. Project = Base_Average
2. Kinematic DLL for GPS input configuration
3. System offsets were set to 0,0,0 for this test
4. Geodesy was set for the above listed UTM Grid.

Position observations will be recorded for a sixty minute period. These observations will then be averaged and assigned as the project RTK base stations horizontal (WGS-84 Lat Lon) and vertical elevation (WGS-84 Ellipsoid).

The project RTK base will then be set up as a reference station, sending corrections based upon the assigned position. The following parameters will be used:

Configuration Toolbox file BASE.cfg

1. Generate CMR correctors on Port 1
2. Kinematic base unit
3. A elevation mask of 8 degree's
4. A PDOP mask of 5
5. Reference position of Lat 35 50 37.98404 N , Long, 075 39 15.87987 , -23.826 Elev. (NAVD88)
6. Antenna height set to 000.00 and antenna type set to **UNKNOWN (0.0 offset)**

The data from each file will be processed through SB-MAX where it will be filtered to only GPS Mode 3 points with an HDOP of <=2.0. These values will then be averaged and also the min & max values will be observed.

2.2 Static Draft Measurement

- **Establishment of Vessel Reference Position**

Prior to survey operations, a Vessel Reference Position was set for use in post processing. Survey data will be collected by an Isis v5.91 system for processing under the Caris HIPS/SIPS software package. Single beam only data will be collected by a Coastal Oceanographics HyPack MAX v0.5b system for processing under the Caris HIPS/SIPS software package. During survey operations, no physical offsets will be entered into the Isis system. Therefore, all offsets and corrections should be handled by the Caris package. It should be noted that an average sound speed for the water column and Side Scan "Horizontal Layback" will be input into the Isis raw data package. This information will be discussed in the appropriate system sections.

With this in mind the following Reference Position was established based on the definition of a Vessel Coordinate System provided in the HIPS User's Guide.

> **Vessel Coordinate System**
> Vessel configuration is based upon an instantaneous, three-dimensional, vessel coordinate system. The
> Origin of the coordinate system is the reference position (RP). The axis is defined as follows:
> The Y-axis is oriented along the vessel's fore/aft axis, positive forward.
> The X-axis is oriented along the vessel's port/starboard axis, perpendicular to the Y-axis, positive
> to starboard.
> The Z-axis is perpendicular to the X-Y plane, and positive down (into the water).

The Y-axis is located approximately mid ship at the fore/aft centerline created perpendicular to the location of the A-Frame.
The X-axis is located at the approximate port/starboard center of the vessel.
The Z-axis was located at the rear deck level, slightly above the water line of the vessel during setup and sea trials

Once this point was established, measurements were made to determine the physical offsets of all survey equipment based on this coordinate system. These measurements were compiled and displayed in the AutoCAD 2000 file called R/V Willing.dwg. This drawing contains all sensor offsets.

During the establishment of system offsets a "Reference Mark" was set to aid in monitoring vessel Static Draft. The Reference Marks are located on the starboard single beam transducer mount vertical member, The distance from the Reference Mark to the Z-axis is 1.20 meters.

2.3 Monitoring Vessel Static Draft

To correctly process soundings, Caris needs to know the position of the Reference Point during survey operations. This point will move as equipment load, personnel, and fuel levels change. To

compensate for these changes the Static Draft is monitored daily. At the start of every survey day the motion sensor is monitored to determine vessel attitude and a measurement is made from the Reference Mark to the present waterline. If the vessel is experiencing a roll bias, due to fuel load, personnel are moved to steady the vessel at its standard attitude. This attitude was established during sea trials, by approximating vessel loads and "zeroing" the motion sensor.

- **Appling Static Draft**

The measurement is logged in the daily spreadsheet and is reduced to a static draft value that is subtracted from the distance to the zero vertical reference and the difference entered in Caris.

- **Static Draft Variation**

The Static Draft is monitored daily as mentioned above. The Static Draft of the vessel appears to have a maximum deviation of 0.01 meters. The data to date is summarized below:

Fuel Load	Static Draft (meters)
Full	0.080
.9	0.080
.8	0.080
7	0.079
.6	0.079
.5	0.079
4	0.079
.3	0.079
.25	0.079

2.4 KTD File Development for RTK GPS Water Level Data Collection and Raw Data Collection

We will be collecting RTK GPS water level elevations throughout the survey area and will be saving them as water elevations referenced to the NAVD 88 datum. This requires the preparation and use of a .KTD file. The KTD file models the difference between the ellipsoid height and the collection datum (NAVD 88) throughout the site.

3.0 HYDROGRAPHER OPERATIONS

3.1 Start of Day - System Start-up and Dock Side Checks

Upon arrival to the vessel on a planned survey day, perform the following functions or verify their occurrence. These items should be done every day before departure.

- Start generator and switch system power from shore to generator.
- If system was shut down the night before, turn on both UPS main power switches and wait for the units to power up. Trip the TEST switch once on both units to apply power to the outlets.

3.2 Start of Day – Electronics Systems Start-Up

- Verify DC Mains, 448, 595, and Autopilot are off before powering up, or logging onto, the computer systems.
- Verify that the monitors are all off via the switch on the monitor outlet strip.
- Power up the Triton Elics, NOAA 1 & NOAA 2 computers.
- Turn on the monitors via the switch on the outlet strip.
- Computer 1 & 2
  - Log on using default Logon
    - User Name osiuser
    - Password (blank)
- The Triton Elics machine is Windows 2000 and has no log on screen
- Wait for all three computer systems to fully boot
- Turn on DC Mains switch. This powers the DMS2i-05, 7400, T4000s, MX51s, CTD and radio modem
- Put the Autopilot in standby
  - Observe compass = 244 - 250 degrees
- Verify computer date/time on each system
  - Open the H11032 vessel log.xls and enter the crew arrival time, vessel departure time, and crew initials.

3.3 Start of Day - GPS Systems Check

- Activate REMCON
  - Select CLEAR to acknowledge power-up
  - Select POSITION
    - Verify Mode is RTK FIX
    - Verify position
      - Lat ~ 35 50 40.8
      - Lon ~ 75 39 19.6
- Minimize REMCON

3.4 Start of Day – Klein 595

- Check mount
- Check connector
- Check cable and lock ring

- Check Fish body screws
- Apply power to unit
- Press "any" button to start system
- Press enter once, and left arrow once to stop printer

3.5 Start of Day – Innerspace 448

- Verify paper supply in unit
- Set power to on to verify date and time – correct if necessary
- Set power back to standby
- Add Start of Day Annotation
    - Registry #
    - Julian Date
    - Calendar Date
    - Vessel
    - Transducer in use
    - Operators
    - Roll #

3.6 Start of Day – Logging

Open Survey Log
Log date and personnel on board
Log WX observations at start of day
Log activities at dock

3.7 Start of Day – HYPACK MAX

- Open Explorer
- Create a folders in the HYPACK/PROJECTS//DATA1/ folder with a naming scheme of ###MAX1 where ### is the Julian date of the survey day. (Daily survey directory) Create a separate folder for each survey day.
- Start Hypack MAX
    - Verify that correct Line File is Enabled
    - Verify that correct background chart is enabled
    - Verify Geodesy
- Start Survey
    - Open Dialog box under Options/Project Options
        - Set Project directory to the daily survey directory.
        - Set the Target directory to the daily survey directory.
        - Verify that the other information is correct and that Long Filenames are enabled.
    - Verify all alarms are off (except 448)

- Verify that all equipment is in normal locations (generator, etc.)
- Ensure vessel is in Reference position. Have vessel captain move the vessel as needed. In Survey, click on Targets, Select, and then Change File. Select the file NAVCHK.TGT from the project directory. Select the dockside nav-check point and right click on it to "select" target. Observe distance to target. If distance is excessive. (Value +/- 1.5 meters) determine what the problem is and correct it. Take a target (F5).
- Modify the target properties (F6) to name it *XXX AM NAV CHK* where XXX is the Julian Date. Add entries in Comments section: *Pitch X.X Roll X.X Hdg XXX.X* in which you record the observed pitch, roll, and heading as observed at the dock.
- Dockside Limits:
  - Pitch 0.0 +/- .2
  - Roll 0.0 +/- .5
  - Heading 246 +/-5 deg.
- Evaluate if values exceed the limits.
- Log the time in the "activity sheet" of the H11032 survey. Also, place an "x" in the roll, pitch, and heading columns on the same sheet to indicate they have been checked.

- **Dockside static draft:**
  - Observe the ROLL value from the MRU and move people to normal positions within the vessel, or as necessary to compensate for fuel load, to achieve a "zero" roll while measuring the static draft from "Reference Mark" to the water's surface. Record the measured value in survey log. Correct the measurement to true static draft value with formula provided. Also note the RTK tide displayed on the NOAA1 Hypack Max data display and enter it in the daily log sheet.
- **Dockside RTK water level check**
  - Observe the local water level reading and enter it in the RTK vs. Observed section of the daily log sheet. Compare the NAVD-88 value calculated by the log sheet with the value recorded from Hypack Max.

3.8 Start of Day – ISIS

- Open Windows Explorer
- Verify space unavailable on data drive E: > 10 GB. If less than 10 GB you need to clear out older (already archived) files to make space.
- Create a new directory on that drive in the H11032 ISIS folder based on the following format:
  - XXXISIS - With X = to Julian day
- Minimize Windows Explorer

- Start ISIS system from the H11032 ISIS shortcut. (This starts ISIS with the correct config file)
    - Set working directory for Isis under Configure>Hypack DDE> *Start each filename with* to daily directory
    - Set Target working directory under Tools>Target>File>Set Working Directory
- Verify next contact number is set in Tools>Target> Edit>Set Contact Number
- Set unit to Start Record to screen only- File>Start Recording>Display Only
- Set Layback—View>Layback>Enter value>Accept
- Set threshold in waterfall by right click—Threshold =1
- Set waterfall window values as shown below
- Open Sensor window- Windows>Status & Control>Sensors
- If you want to view 448 depth - Aux 1 displays depth
- Open Altitude window
- Click on symbol of Alt: in Telemetry window of Parameter Display

- **Annotations**
    - Annotations are kept in a WordPad document name JD###.TXT where ### is the Julian Date. This file is kept open on the Isis machine and annotations are copied and "pasted" into the **NOTE:** section of the .XTF.
    - SSS annotations must be recorded in the notes section of the Isis box at:
        - At start of line
        - When surface objects are noted
        - When SS tuning, range, cable out, or any other parameters are changed

4.0 CONFIDENCE CHECKS

Confidence Checks H11032-JD160-06092002-RV WILLING II/PORT

Confidence Checks H11032-JD160-06092002-RV WILLING II/STBD

Confidence Checks H11032-JD160-06092002-RV WILLING II/BOTH

Registry#/Julian Date/Calendar day/Towing Vessel/Channel

5.0 INTERFERENCE

H11032-JD160-06092002-RV WILLING II/Wake

H11032-JD160-06092002-RV WILLING II/Biologic

Registry#/Julian Date/Calendar day/Towing Vessel/Type of Interference

- **6.0 DURING TRANSIT TO SITE**

  - Ensure the shore power cable is stowed.
  - Remove all dock lines and depart.

7.0 ON-SITE – PRIOR TO SURVEYING

- Determine sound velocity and enter into machines
- Isis – **Configure/Sound Velocity**
- Hypack Max – **Options/Navigation/Roxann Sound Velocity**
- Innerspace 448 – Dial in as **Speed of Sound**
- Bar Check
- Depth confidence check
- Deploy SSS for appropriate tow
- Check SSS Range

7.1 Daily Average Speed of Sound

- Obtain speed of sound readings. Enter in 448, Isis, and in HYPACK MAX - Survey, under OPTIONS, Navigation Parameters as "Roxann Sound Vel. Verify value is representative of prior values.

- **7.2 BAR Check (Depth)**
  - Verify that the average speed of sound from the days first cast is entered into the 448
  - Lower the barcheck to the lowest 1.0 meter increment available referencing the 1 meter marks to the 448 draft mark on the transducer vertical pole.
  - Start the 448 paper and record the bar at one meter intervals to 1.0 meters.

- **7.3 Confidence Check (Depth)**

  - Check 448 to insure correct sound velocity entered, draft=0.0, tide=0. Mode Auto, gate 4, replies 8. Turn 448 from STBY to ON just prior to check to record date, time, speed of sound, and draft on paper record.
  - Record depth on paper record as Hydrographer lowers bar to seafloor. On the "MARK" given by the hydrographer as the bar is touching the seafloor, toggle the FIX MARK switch on the 448. The hydrographer will measure the distance from the seafloor to the water surface using the barcheck marks and

by measuring between marks. Take target.(F5) Name target XXX Depth Confidence Check. Return 448 to STBY mode.

- Annotate paper record with:
  - Depth Confidence Check
  - H11032
  - Julian Date XXX
  - Operator Initials
  - Bar Check = X.X m (meters)
  - Calculated 448 depth by adding displayed depth to daily static draft.

7.4 Confidence Check (Sidescan)

- While collecting data:
- ISIS operator will enter the appropriate annotation into the **NOTE:** section of the .XTF while online. The time is entered into the daily log and noted as a confidence check .
- At times other than during regular data collection
- A line can be run outside of regular data collection to demonstrate that the sidescan sonar system is able to detect targets out to the full extent of the selected range. The Hypack operator selects line 900 to record the data. The XTE value in *Survey/Options/Navigation Parameters* should be changed to 200000 to avoid unnecessary TEXT log entries. Start the line when ISIS is ready.

8.0 BEFORE ON LINE DATA COLLECTION

8.1 Computer 1 - Hypack Max

Start Survey

Verify correct line entered, and line azimuth is correct. Change if necessary.

8.2 Computer 2 - Hypack Max

Start Survey – start logging prior to BOL.

8.3 Innerspace 448

Turn 448 alarms on (if off) – verify digital depth is ok Start Paper

8.4 ISIS

Verify ISIS is ready.

8.5 Heave

Verify Heave is ready.

Create a target (F5) and change it's properties (F6) to DECK CTD = XXXX.X. (The value observed at the beginning of line)

9.0 START OF LINE

- Save / Clear any contacts in the Target window
- Verify SSS data quality and bottom track prior to start
- Verify coastal line start of Isis
    - Watch file size increment
    - Check destination directory for file

10.0 ONLINE

Observe digital depths, heave, and profile window to verify proper operation. In shallow areas assist the vessel helmsman by closely monitoring the depth of water. Immediately notify helmsman of hazardous condition. Watch water depth to QA/QC alt. of SSS. Watch vessel speed.

Observe Sidescan record in Isis. Mark targets & put target in Hypack so as to allow checking the target on the next pass.

Periodically observe Deck CTD value, DIM value, heave, vessel speed, and CTD time interval. Observe Navigation map for holes in Isis.

10.1 Gap Tracking - Sidescan

If a condition is observed that may create a gap in the Sidescan data the operator hits F5 on Computer 1 to create target. The operator then evaluates further. If a gap is declared the target will be called up for modification (F6). The default name in the target name field will be changed to XXX SS GAP; where XXX is the julian date. Further info will be entered into the notes field as follows:

Start & end time of gap, channel (port/stbd) Line designation
Example:
034 SS GAP
Notes: 16:37:00 to 16:37:45, Port Channel, Line 201_1549.034, type of interference
Ensure that Gap is entered in H11032 daily log.

10.2 Gap Tracking - Singlebeam

Hypack operator hits F5 and creates a target as SB gap is seen. Operator modifies target (F6) to change name to XXX SB GAP. (XXX is the Julian date) Ensure that Gap is entered in survey daily log file.

- **11.0 END OF LINE**

  - Save all contacts as follows, and report final contact number in log
    - Target>File>Save All>Yes if not saved already

12.0 END OF DAY

Review ASCII text file for alarms

12.1 End Of Day - ISIS

- Exit from Isis
- Close Target window if still active
- Log off machine or shut down based on required backup situation

12.2 Archiving Procedure

- Data from all sources is colleted in Computer 1archive for archiving and data transmittal preparation
- A separate directory is established for each survey day with a subdirectory structure where each type of data is stored
- The structure and file types are outlines below

DIRECTORY NAME		FILE NAMES	
XXX Data\Docs	All documents created	H11032 Survey Log.XLS	Summary of all activities
		Willing II_offsets_1_19.DWG	Vessel layout and system offsets
XXX Data\XXXisis	All Isis data files	*.XTF XXX.LOG *.CON, XXX-00-contact.TXT	All .XTF files from the day Daily Isis survey log Original Isis contact files

XXX Data\Max_Support	Hypack MAX support files	Varied file types	Setup and support files for Hypack MAX operation Hypack MAX operations and alarms summary .INI files used for MAX
XXX Data\XXXmax1	Hypack MAX data files and .log file	*.RAW *.TGT	All Hypack data lines .TGT is MAX target file

- A directory template is available with all subdirectories established with an XXX, copy this template to Computer 1 and replace XXX with Julian day.
- Removable Hard Drive
  - A copy of each days data are copied from Computer 1 to a removable hard drive at the end of each survey day.
  - The Drive is then taken to the project office where the data is archived.
- XTF Data
  - Move the survey log from D:\root to daily directory at the end of the survey day
- Hypack Data
  - Copy both the TGT and the TXT file for the day to the data archive.
- Document Files
  - Copy the Daily Survey Log to the Daily Directory Doc section
  - Copy the Master Log.XLS to the Daily Directory Doc section
  - Copy any other relevant documents or drawings to this section
- Misc Section
  - Place any other non-standard files into this directory.

- **12.3 <u>End of Day: System Shut Down and Dock Side Checks</u>**

Upon arrival at the dock, perform the following functions or verify their occurrence. These items should be done every day before departure from the vessel.

- Secure all dock lines and hook up the shore power cable upon arrival at the dock, log arrival time in vessel log.
-
- Read the vessel fuel gauge and enter the value in “Activities Section” of Daily Log
- Capacity is approximately 120 gallons

- Ensure vessel has all appropriate supplies for the next day. Fuel, disks, FEDEX supplies, food, paper supplies, and water.
- Switch the system over to shore power after verify unneeded systems are off.
- Turn off the DC Mains and Autopilot.
- Verify you have the Data package and any files that will be e-mailed with you.
- Ensure all lights and boat electronics are off. Check all windows. Ensure bilge pumps are on. Lock back door upon departure.

12.4 Misc. System Operations

12.4.1 Klein 595

- Lower fish into the water to test operation

- Deploy fish and note cable out for layback calculations.
- Verify SSS image quality on Isis

- End of Day
  - Power Off
  - Recover Fish
  - Inspect entire wet end of system for wear – damage

12.4.2 Innerspace 448

- On-site
  - Input average speed of sound from first SVP and verify entry into all other systems
    - 448 – Hypack – Isis
- Start of Line
  - Alarm on
    - Good bottom lock
  - Verify range, gain, mode, and gate settings for upcoming line conditions.
  - Verify proper sound velocity based on first cast
  - Unit in standby power unless performing confidence check or time check

- End of day
  - Turn unit off
  - Remove and archive sounding roll
  - Verify Sounding pole is raised
  - Verify paper supply on board

- Periodic Maintenance

- Clean print head

APPENDIX 3

(The attached SOP includes Attachment A: *Ocean Surveys, Inc. Manual of Standard Operating Procedures.* This attachment contains SOPs for the operation and calibration of navigational and geophysical survey instrumentation. Not all of the SOPs included in this attachment apply to the Sub-Bottom Profiling Test SOP.)

STANDARD OPERATING PROCEDURE FOR SUB-BOTTOM PROFILING SURVEYS

1. Tests of acoustic- and GPR-based sub-bottom profiling equipment will occur over two to three week period on the Upper Hudson River just north of the Northumberland Dam near Hudson River Mile (HRM) 184 and in the Thompson Island Pool, near HRM 190 at Griffin Island, and near HRM 189.4 at Moses Kill. Since this is a well-traveled navigational channel, the work will be coordinated with the Canal Corporation, as required by the Health and Safety Plan and the Community Health and Safety Plan. In addition, the sampling vessels will maintain contact with the Canal Corporation using marine band channel 13.

2. The sub-bottom profiling tests will utilize GPS receivers (Trimble 7400 MSi) to acquire navigation data using shore-based reference stations with known coordinates and elevations. Differential correctors determined at these stations will be transmitted to the survey vessel where they will be used by the onboard receiver using Real Time Kinematic OTF software to determine the accurate position of the GPS antenna in the vertical and horizontal planes. These data will be logged on board at one-second intervals for the duration of the survey. Data quality parameters will also be logged and monitored by the onboard navigator with flags put on all data points which do not meet the quality limits set. The specified accuracy for this system is +/- 2 cm when satellite configuration is sufficient.

3. The sub-bottom profiling tests will focus on one technique at a time – either acoustic or GPR. Tests of the acoustic sub-bottom profiling equipment will be tested along 4-5 transects at each survey location using an EdgeTech Geostar Chirp sub-bottom profiler with both 4-24 kHz and 2-16 kHz transducers. Once the acoustic survey is completed, tests of GPR sub-bottom profiling techniques will be conducted along the same transects using a

GSSI SIR 2000 Ground Penetrating Radar system with 100, 200, 300 and 500 MHz antenna.

4. Before leaving dock, the sub-bottom survey crew will check to make sure all navigation and instrument systems are working properly. Calibrate and set navigation instruments based on the instrument-specific standard operating procedures (Attachment A). Prepare survey equipment for start of daily survey operations including: deployment of sonar tow fish into water (or deployment of GPR antenna), measurement of survey equipment offsets, daily speed of sound test, and other required pre-survey activities.

5. Navigate to coordinates of first transect. Transect coordinates and headings are based on tracklines that intersect Sediment Sampling and Analysis Program (SSAP) coring locations in the vicinity of historical coring locations that show stratification of a variety of sediment types. Transect coordinates and headings will be provided to the sub-bottom survey crew for import into the navigation computer. A Coastal Oceanographics "Hypack Max" will be used for trackline design, navigation, trackline control, and digital depth and RTK DGPS data logging.

6. Align survey vessel along longitudinal transect and confirm autopilot heading and operation. Start data acquisition and commence sub-bottom survey tests along transect. Conduct acoustic (or GPR) sub-bottom profiling tests. Test multiple frequencies along transect and note frequencies of highest resolution. Export and log the sub-bottom imagery to the ISIS data acquisition platform. Enter all system annotations in the ISIS XTF notes field.

7. Use a digital depth sounder to collect water depth information along each transect. Log depth data to the Hypack Max system.

8. During the survey, perform periodic manual probing and visual characterization of sediments. Note coordinates and results of probing or characterization in the field log. Note coordinates of areas that may need additional confirmatory sampling and sediment grain size analysis to ground-truth the sub-bottom data in the field log.

9. Note relevant observations and changes in operational procedures to the field log. These may include: coordinates of observed obstructions or artifacts; areas where interferences or other conditions limit survey resolution, and coordinates where adjustments to the tow fish or GPR antenna are made. Repeat survey of the entire transect using acoustic (or GPR) frequencies that showed highest resolution during preliminary survey tests.

10. At the end of each transect, confirm successful data acquisition and storage, navigation and equipment calibrations and settings. Log time and coordinates at end of each transect line surveyed.

11. Prepare equipment for navigation to next transect; navigate to next transect.

12. Repeat steps 4-12 and collect sub-bottom data along each transect until representative sub-bottom data for each has been acquired in each survey section for each survey technique - both acoustic and GPR.

13. All raw survey data and information (e.g., field notes, instrumentation frequencies) must be documented electronically or in a field note book. At the end of each day, check daily computer data from the Hypack Max and ISIS systems for error flags. Output all notes to an ASCII file and store with the raw records. Back-up copies of the raw electronic data and make copies of all field log entries.

ATTACHMENT A

OCEAN SURVEYS, INC.
MANUAL OF
STANDARD OPERATING PROCEDURES

(Geophysical Survey Instruments)

1.1.1.1.1 TABLE OF CONTENTS

Page

1.0 INITIAL EQUIPMENT SETUP

This is a draft document. The most recent modification was on 07/31/02 by MLK. New versions will be distributed as they are created.

There are presently several documents that are associated with this that are not included at this time.

1 Caris offset drawing
2 Hypack offset drawing
3 System wiring document
4 System comm. Port settings and data formats

1.1 General Tasks Before Start of Survey

- Obtain reviewed Survey Plan
- Notify GE of vessel movement
- Obtain permits for movement through and between locks
- Obtain proper charts and update with all Notice to Mariners
- Verify availability of CG DGPS correctors and RTK stations
- Document equipment installation
    - Establish Boat 0,0,0
        - Vessel fore/aft centerline, aft edge of athwart ship I-Beam on A-Frame, point on aft deck slightly above waterline
    - Measure and record all offsets
        - Trimble 7400 MSi DGPS's
            - Navigation antenna X, Y, Z
            - Reference antenna X, Y, Z
        - Trimble 7400 RTK GPS
            - Antenna to waterline
            - X & Y to boat 0,0
        - Innerspace 448 X, Y, Z

- TSS DMS 2i-05
  - X, Y, Z
  - Zero out mounting angles with appropriate vessel loading – see procedure in TSS section

- Robertson Compass
  - X, Y
  - Align to true heading of vessel centerline – see procedure in Compass section

- Sidescan Tow Point X, Y, - Z left at 0.0 m for proper Caris import of layback

- Subbottom Profiler Tow Point X, Y, - Z left at 0.0 m for proper Hypack import of layback

1.2 Equipment Setup

1.1.1.1.2 ***1.2.1 Trimble 7400 Receiver***

- Initial Settings
  - RTCM Output = off
  - RTCM Input
    - Inputs ON
    - Port = 2
    - Format = USCG
    - ASCII Printout off
    - Beeper Off
    - Station = any
    - Age Limit 20 sec.
    - Integrity Monitor Off
  - Power Up Control
    - Do not default controls at power up
  - SV Enable/Disable
    - Disabled mode = none
  - Adjust local time

        - Time offset EDT-UTC = -4 hrs
        - Time Zone Identifier = EDT
    - Baud Rate Format
        - Port 1 = 9600-N-8-1
        - Port 2 = 9600-N-8-1
    - Remote Protocol
        - Data Collector Compatible
    - Reference Position
        - Lat = 35 50 40.91718
        - Lon = 075 39 19.57021
        - Height = -37.529
        - (Note, may be changed during survey by selecting **HERE** to get local position and current ellipsoid height for Lat/Lon – Fixed height)
    - Masks/Sync Time
        - Elevation Mask = 8
        - PDOP Mask = 5
        - SV Sync Time = 1.0
    - Positioning Modes
        - Weighted solution enabled
    - Lat/Lon Height Always
- Power Controls
    - Charger and Power output disabled
- NMEA 183 Output
    - Port 1 Enabled
        - GGA, VTG, ZDA
- Cycle Printouts = Off
- 1 pps output = disabled
- Default controls – **DO NOT USE!!! RESETS TO FACTORY**
- Modify
    - Units of Measure
        - Lat/Lon Degrees = Deg.Min.Sec.
        - Time = 24 Hr UTC
        - Position = WGS-84 LLH
    - Altitude Reference
        - Height above ellipsoid

1.2.2 MX-51 Beacon Receivers

- Initial Settings - DGPS1

- **HUDSON FALLS, NY**
  Status: Operational
  RBn Antenna Location: 43° 16.21' N73° 32.31' W
  REFSTA Ant Location (A): 43° 16.2491' N73° 32.34705' W
  REFSTA Ant Location (B): 43° 16.2637' N73° 32.34534' W
  REFSTA RTCM SC-104 ID (A): 94
  REFSTA RTCM SC-104 ID (B): 95
  REFSTA FIRMWARE VERSION: RD00-1C19
  Broadcast Site ID: 844
  Transmission Frequency: 324 KHZ
  Transmission Rate: 200 BPS
  Signal Strength: 100uV/m at 135NM

- CTToolbox should be used to reload H11032R.CNF (config file) if necessary. The following settings are in H11032R.CNF
  - CONTROL/BASE STATION
    - Input using **HERE** at Hudson Falls
    - LAT 35 50 40.77420
    - LON 075 39 19.81768
    - HGT – 0035.870
    - ANT Height 000.000
  - CONTROL/SV ENABLE/DISABLE
    - ALL – ENABLE
  - CONTROL/GENERAL CONTROLS
    - ELEV. MASK: 08
    - PDOP MASK : 05
    - MEAS RATE 1 HZ
    - MOTION: KINEMATIC
  - CONTROL/POWER CHARGER
    - POWER OUTPUT MODE DISABLED
  - CONTROL 1PPS OUTPUT
    - 1 PPS OFF
    - ASCII TIME TAG PORT OFF
  - CONTROL SERIAL PORT OUTPUT
    - NMEA/ASCII OUTPUT
    - GGK
      - PORT 2
      - 1 HZ
    - ZDA
      - PORT 2
      - 1 HZ

    - All others off
- STREAMED OUTPUT
    - ALL OFF
- RT17/BINARY OUTPUT
    - ALL OFF
- CMR/RTCM
    - BASE – MOVING
    - CMR PORT – OFF
    - NAME - cref
    - RTCM PORT – OFF
    - TYPE - 1
- CONTROL/SERIAL PORT SETUP
    - PORT1 9600 8-NONE-1
    - PORT 2 9600 8-NONE-1 NONE
    - PORT 3 9600 8-NONE-1
    - PORT 4 9600 8-NONE-1 NONE
- CONTROL/INPUT SETUP
    - USE RTCM STATION – ANY
    - RTK/DGPS AUTO SWITCH RANGE – 20.0 KM

1.2.3 Compass (Side scan sonar operations)

- Initial Calibration Procedure
  - Load vessel, as it will be for survey ops. Remove any large ferrous objects from the vicinity of the compass.
  - Position the vessel in open water
  - Apply power to the Robertson autopilot
  - Begin by turning the vessel to starboard.
  - Select **INSTALLATION/RFC COMP calibration**.
  - Calibration should complete after ~ 1 ¼ turns and should be verified by a display of **Calibration confirmed**.
- Determine and apply Compass Offset
  - Con the vessel on a straight line while observing the heading computed by the GPS system.
  - Adjust the offset by turning the autopilot knob to match the pilot compass heading to the gps heading. Note the applied offset. (This puts the pilot compass into "TRUE" heading.)

1.2.4 TSS DMS 2i-05 (Hydrographic survey operations)

- Initial Settings
  - Set baud rate/format to 19200,N, 8,1
  - Heave bandwidth = SHORT
  - Output Rate = 50 hz.
  - GPS data input settings = NMEA Local 9600, 8, N, 1
    - Check GPS RAW and CALCULATED input
  - GYRO data input settings = NMEA Local 4800, 8, N, 1
    - Check Compass RAW & CALCULATED INPUTS
  - Data output format = TSS1 19200, 8, N, 1
  - Zero out mounting angles. Document mounting angles with screen grab.
    - Stabilize vessel with static loads approximating those that will be experienced during the survey.
    - Access TSS through communication program and set mount angles automatically by averaging data for 5 minutes
    - Accept values and screen grab settings

Restart TSS operation and exit from program

Mount Angle Setting Recorded

06/04/02

```
---------------------------------
DMS 2-05 Version 2.03 Terminal Mode
---------------------------------
Sensor Mounting

Orientation : Vertical
Roll  Mount Angle [  1.741  deg] :
Pitch Mount Angle [  1.711  deg] :
Yaw Mount Angle [  0.000  deg] :
```

- **Do Not Change These Settings!**

1.1.1.1.3

1.2.5 Innerspace 448 (Hydrographic survey operations)

- Initial Settings
  - Verify the following initial settings
    - Gain = Approx. 10 o'clock setting
    - Range = 0-15 M
    - Mode = Meters
    - Chart Speed = 4
    - Range Multiplier = X1
    - Input default speed of sound of 1500 m/s
    - Set draft = 0.0
    - Tide = 0
    - Initial = 5
    - Gate = 2
    - Mode = Gated
    - Reply = 16
    - Alarm on during survey
    - Set variable power TX board to Low, to limit interference with SS and MB
    - Set internal TVG curve switch to open/open or +60 db. This was needed to receive quality data at the above mentioned low power setting with our combination of components
    - Set date & time – See back of paper carrier
    - Load paper per picture on back of paper door

1.1.1.2

1.2.6 Klein 595 (Side scan sonar operations)

- Initial Recorder Setup
  - Set system to factory defaults by pushing left button on the CPU board
    - This resets all values to factory default
    - It also resets all gain curves and other "adaptive controls prior to calibration
      - A calibration should be preformed, per the manuals description any time a component is changed, like a cable or fish
  - Set time/date in submenu
    - Add "*" to time and date to print it when an event is pressed. This can be used to log tuning changes and rub tests
  - Set system to the following values:
    - Auto CPU
      - Altitude = 0,0
      - Return = 0
      - Offset = 2
    - Auto TVG Port
      - Normal
      - Atten. = 9
      - Salt Water
    - Auto TVG Starboard
      - Normal
      - Atten = 9
      - Salt water
    - Printer = Off
    - Range = 25 Add "*" to field
    - Scale lines = 10 Add "*" to field
    - Source = Fish
    - Channel = 1 | 2
    - Speed = Manual –1.0 Set to avoid alarms
    - Altitude = Auto
    - Mapping Mode = Off
    - Altitude Alarm = Off
    - Auto Mark = Off
    - Event Count = Off
    - Event Mark = Off

        - Side Scan Expand = Off
        - Profiler Expand = Off
        - Nav Source = Nav3* - used for external Eventing option
    - Follow the calibration found in the operations manual on 3-34 to tune for site conditions
    - Document tune-up settings in SSS annotations
    - Document tow configuration and Cable out in SSS annotations
        - Tow Point
            - See attached drawing for exact location
            - The tow point is a sheave mounted to a bowsprit. In operation the fish is lowered to1meter in the water as the vessel is moving at survey speed.
            - The cable is fair leaded back to the stern on the outside of the bowsprit mount. Cable out measurement is taken from the point of the sheave closest to the mount point
            - The layback was measured by observing the fish under survey conditions and measuring from the center of the xducers to the tow point.
            - Document any changes made to the recorder online in the Isis notes section
    - Initial Fish Setup
        - Depression angle = 20 degree's
        - 500 KHz only
        - 100 KHz disabled in fish – SCR trigger is disconnected.
        - Attach depressor to fish

    - Internal Jumpers
        - A/D board jumpers should be set to reflect proper software version (checked 050202)
        - Fish Tape I/O jumper should be set to either 15v for short cable or 24v for long cable (winch) (checked 05/2/02 set to 15v)
        - Verify which channel is tracking altitude on the Connector interface board

1.2.7 EdgeTech Geostar (Sub-bottom profiling operations)

The power amplifier power input is manually set to 110 or 220VAC. To access the switch on the amplifier, it must be removed from the 19" rack, the switch is located on the right side of the unit. The monitor and the computer are auto sensing.

1.2 Operator Controls (refer to GeoStar manual before modifying any of the default control parameters)

Review the following parameters and select to optimize data quality:

a) Normalize gain control
b) Select display gain for either or both channels (From 1 to 97, in increments of 3 dB)
c) Set Time Varying Gain (TVG) for either or both channels (From 0 to 30, in single increments)
d) Select one or two channel display based on transducer number
e) Bandwith selection (Full, High or Low)
f) Set vertical zoom (1/2, 1, 2 or 4 times) based on range and water depth
g) Set Mode selection (Acquire or Playback), acquire for data collection
h) Select Time and Data source (CPU or GPS)
i) Select Start depth (A/D delay) of display and acquisition 0 to 200m below the fish
j) Review Pulse selection (3 pulses for each towfish)
k) Set data storage selection (Iomega Jaz or hard-drive)
l) Data file management (deleting unnecessary files)
m) Set decimation factor
n) Select printer (EPC 1086) if using printer
o) Quit to shut down the system

1.2.8 GSSI SIR 2000 (Subbottom profile operations)

2.

3. Startup System

- Connect antenna.

- Connect power source.

- Press Power button. The green light above the power button should be steady. If the green light is not steady, your power source is faulty, change power source.

4. Data Collection Setup

- The blue SIR-2000 Startup Screen will appear.

- Press Enter for Standard operation.

- Press the Left arrow for Previous Setup or the Right arrow for Stored Setups.

    - Previous Setup will recall the last used operating parameter.

    - Stored Setups provide a list of factory- and user-defined settings.

- Select a factory setup based on antenna frequency or user defined setup from window using arrow keys.

    - Press the Enter to recall the setup file and then press Enter to confirm.

    - System will initialize (you will see "servo in process") according to selected setup.

5. Data Collect Setup

- The Screen will open with a Linescan display on the left and the O-Scope window on the right. The User menu is navigated with arrow keys.

- The auto setting recalled will set data collection parameters according to "rule of thumb" guidelines. All settings can be changed by the user, if desired. Refer to SIR 2000 manual for additional information

1.2.9 Bar Check

- Initial Setup and Calibration
  - Determine maximum depth of survey and depth units
    - Sheet A maximum depth is in the 10 meter range
    - Survey depth units are meters
  - Construct Bar Check per OSI standards
  - Type 1
    - .2 meter diameter lead disk with eye bolt
    - Imprint a "serial number" onto bar
      - "A"
      - "B"
    - Coated aircraft cable
    - Brass marker beads at appropriate intervals
      - Minimum of every 1 meter throughout the survey depths
      - This is to allow use of a "pocket rod" to read inter bead values
    - Also mark cable on both sides of bead with a "sharpie" to help identify bead slips
    - Measure bead locations with steel tape to the nearest 0.01 meter increment
    - Record bar s/n and all other information required on OSI Lead Line Calibration form
  - Recalibration
    - Recalibrate Bar Check every 6 months, or after any action that could possibly affect the condition of the Bar Check, such as snagging line on bottom.
    - Recalibrate at the completion of the survey
  - Maintenance
    - Periodically examine the eye bolts and cables

  - Type II
    - Aluminum square-beam > width of boat with target at position of in hull xducer
    - Imprint a "serial number" onto bar
    - Coated aircraft cable
    - Brass marker beads at appropriate intervals
    - Minimum of every 1 meter throughout the survey depths
      - This is to allow use of a "pocket rod" to read inter bead values

        - Also mark cable on both sides of bead with a "sharpie" to help identify bead slips
        - Measure bead locations with steel tape to the nearest 0.01 meter increment
        - Record bar s/n and all other information required on OSI Lead Line Calibration form
    - Recalibration
        - Recalibrate Bar Check every 6 months, or after any action that could possibly affect the condition of the Bar Check, such as snagging line on bottom.
        - Recalibrate at the completion of the survey
    - Maintenance
    - Periodically examine the eye bolts and cables

1.2.10 GE 1 Computer System

- Start Up
    - Verify DC Mains and Autopilot are off before powering up, or logging onto, system
    - Log on using default Logon
        - User Name osiuser
        - Password (blank)
- Verify time zone is set to (GMT) Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London.
- DO NOT CHECK "Automatically adjust clock for daylight savings time.

- Start HyPack MAX with appropriate shortcut
    - Open new project named GE-1
        - Create folders in the project folder named DATA1
        - Set geodesy to UTM Zone 18 WGS 84
        - HYPACK HARDWARE SETUP
            - New File
            - NAV - NMEA183.DLL
                - Name = DGPS1
                - Update Frequency = 50ms
                - Type
                    - Position
                - Options
                    - Record raw data
                    - Record quality data

    - Record
        - Always
    - Connect
        - Serial Port
            - COM3, 9600,8,none, 1,Flow Control = none
    - Offsets
        - Starboard = -.35
        - Forward = + .23
        - Height = +1.97
        - Latency = 0.860
    - Setup
        - Standard NMEA 0183 sentences to be used
            - GGA
        - HDOP Limit = 2.5
        - Minimum Satellites = 4
        - Use ZDA message for time tag = Disabled
        - Send alarm when non differential
- Depth – Innerspace 448 {Serial} - IN448.DLL
    - Name = 448
    - Update Frequency = 50
    - Type
        - Echo sounder
    - Options
        - Record raw data
        - Record quality data
        - Paper Annotation
    - Record
        - Always
    - Connect
        - Serial Port
            - COM6, 9600,8,none, 1
    - Offsets
        - Starboard = 0.0
        - Forward = 0.0
        - Height = +.8 NOTE!!! .8 meters used as “display offset”. See Draft explanation
        - Latency = 0.000
    - Setup

        - Send annotation string with event mark
        - Multiply not needed
- Auto Pilot Compass – NMEA.DLL
    - Name = AP Compass
    - Update Frequency = 50
    - Type
        - Heading
    - Options
        - Record raw data
        - Record quality data
    - Record
        - Always
    - Connect
        - Serial Port
            - COM5, 4800,8,none, 1
    - Offsets
        - All zero
    - Setup
        - Sentence to be used
- HDG
- Auto Pilot – NMEA.DLL
    - Name = AP XTE
    - Update Frequency = 500
    - Type
        - Output
    - Options
        - Record raw data
        - Record quality data
    - Record
        - Always
    - Connect
        - Serial Port
            - COM8, 4800,8,none, 1
    - Offsets
        - All zero
    - Setup
        - Sentence to be used
- GGA
    - Sentence to generate
    - APB
    - GLL output places = 4
    - XTE (Nautical Miles) checked

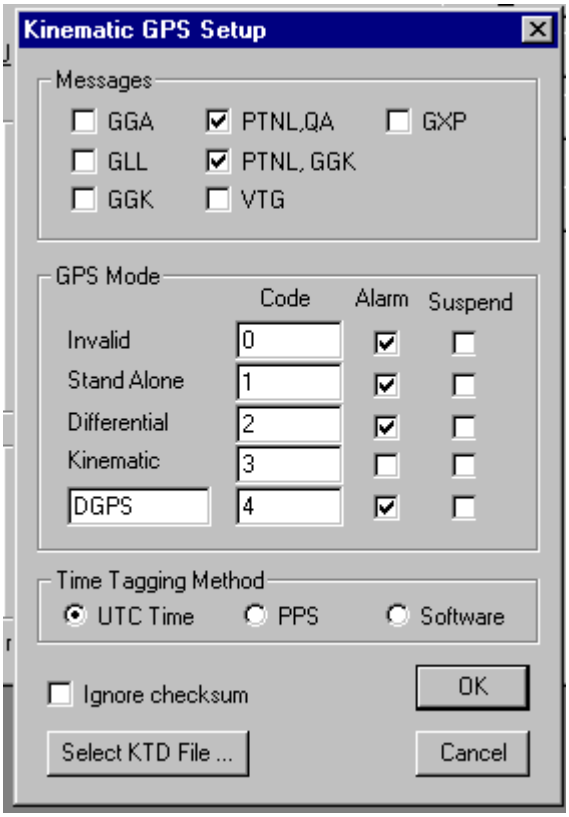
  - Output to hundredth decimal place = Enabled
  - XTE Factor = 0.0

- File Server – Delph Output – DELPH.DLL
  - Name = Isis Out
  - Update Frequency = 20000
  - Type
    - (nothing checked)
  - Options
    - Record raw data
    - Record quality data
    - Paper Annotation
  - Record
    - Always
  - Connect
    - Serial Port
      - COM7, 9600,8,none, 1
  - Offsets
    - All Zero

- TSS DMS2i-05 – TSS320.DLL
  - Name = DMS2i-05
  - Update Frequency = 50
  - Type
    - Heave Compensator
    - Other
  - Options
    - Record raw data
    - Record quality data
    - Paper Annotation
  - Setup
    - Motion reference Unit Only
  - Connect
    - COM 1 19200,8,N, 1
  - Record
    - Always
  - Offsets
    - Position
    - Starboard = -.44
    - Forward = +.47
    - Vertical = -.18

- Yaw = 0
- Pitch = 0
- Roll =0
- Latency =0

- Trimble 7400 RTK OTF - KINEMATIC1.DLL
  - Name – RTK
  - Type
    - Position
    - Echosounder
    - Sync. Clock
    - Tide Gauge
  - Record RAW
  - Record Quality
  - Setup



  - SELECT KTD FILE

        - File 02ES007.KTD used for survey ops

    - Connect
        - COM2 9600,8,N, 1, Flow Control = none
    - Offsets
        - Position
        - Starboard = -1.50
        - Forward = +.25
        - Vertical = + 2.05
        - Yaw = 0
        - Pitch = 0
        - Roll =0
        - Latency =0
    - Record
        - Always

    - Create a second mobile named RTK. Transfer the RTK device to the second mobile

- URS-1 – VHW.DLL
    - Name = Speedlog
    - Update Frequency = 200
    - Type
        - Speed
        - Other
    - Options
        - Record raw data
        - Record quality data
    - Setup
        - none
    - Connect
        - COM 9 4800,8,N, 1, Flow Control = none
    - Record
        - Always
    - Offsets
        - None
- Settlement – DraftTable.dll
    - Name = Settlement
    - Update frequency = 100
    - Type

- Draft
- Setup
  - Create Draft table from Settlement and Squat test
  - Insert Draft table picture – set to 0.0 for squat test
- Offsets
  - None
- Connect
  - Ignored
- Record
  - Always

1.2.9 GE-1 CARRIS OFFSETS to BOAT

DGPS1 (NMEA183.DLL)

STBD	+1.18
FWD	+0.02
Height	+1.97
Latency	+0.00

448 (INN448.DLL)

STBD	+1.53
FWD	-0.21
Height	+0.80
Latency	+0.00

Auto Pilot Compass (NEMA.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

Isis Output (DELPH.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

Auto Pilot (NEMA.DLL)

STBD	+0.00
FWD	+0.00
Height	+0.00
Latency	+0.00

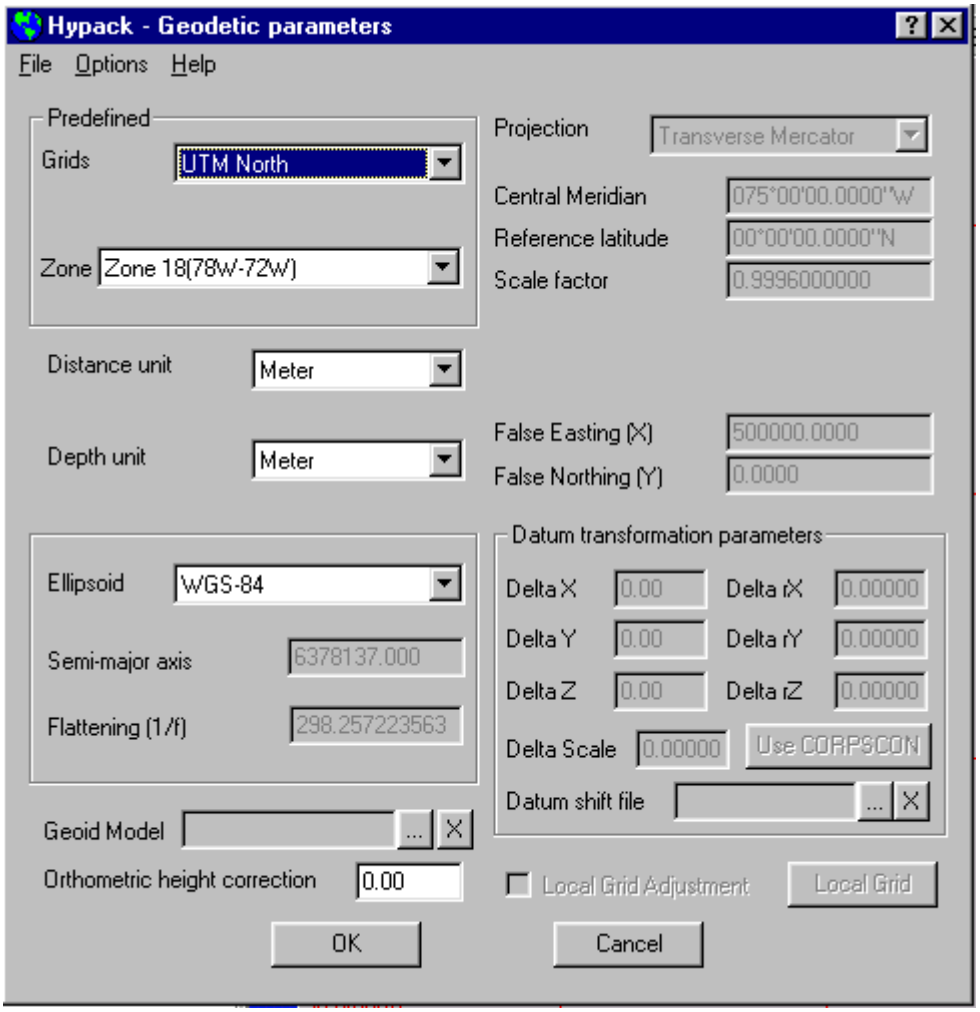
DMS 2i-05 (TSS 320.DLL)

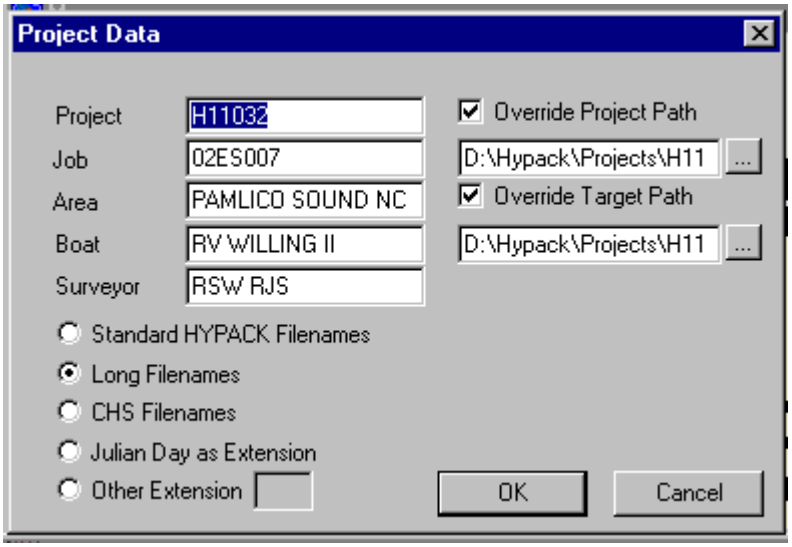
STBD	+1.09
FWD	+0.26
Height	-0.18
Latency	+0.00

RTK GPS KINEMATIC.DLL

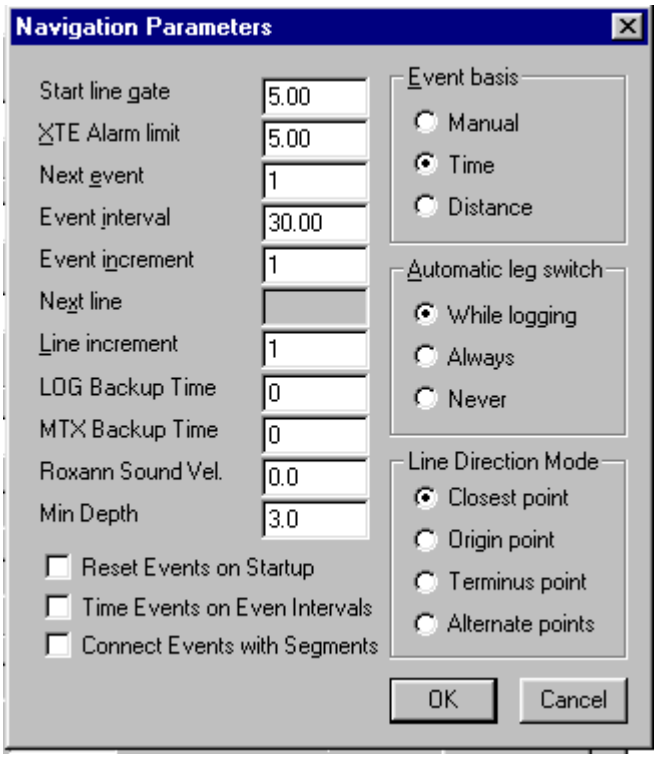
STBD	+0.03
FWD	+0.02
Height	+2.05
Latency	+0.00

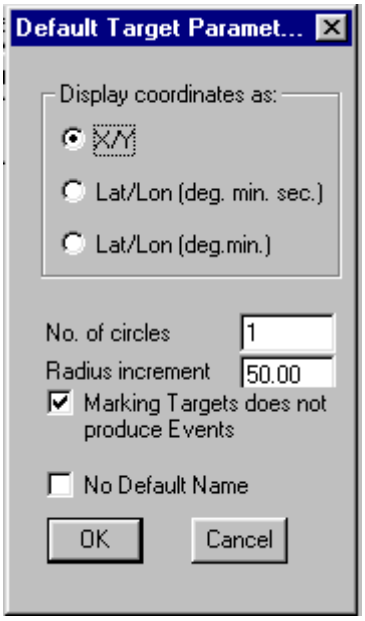
1.2.10 Other Hypack Max Settings


Hypack - Geodetic parameters
File
Options
Help
Predefined
Grids
UTM North
Zone
Zone 18(78W-72W)
Projection
Transverse Mercator
Central Meridian
075°00'00.0000"W
Reference latitude
00°00'00.0000"N
Scale factor
0.9996000000
Distance unit
Meter
Depth unit
Meter
False Easting (X)
500000.0000
False Northing (Y)
0.0000
Ellipsoid
WGS-84
Semi-major axis
6378137.000
Flattening (1/f)
298.257223563
Datum transformation parameters
Delta X
0.00
Delta rX
0.00000
Delta Y
0.00
Delta rY
0.00000
Delta Z
0.00
Delta rZ
0.00000
Delta Scale
0.00000
Use CORPSCON
Datum shift file
Geoid Model
Orthometric height correction
0.00
Local Grid Adjustment
Local Grid
OK
Cancel



NOTE: XTE ALARM set to 100000 for Sea Trials





5.1.1.1 **1.2.11 ISIS**

- Start Up
  - Verify DC Mains and Autopilot are off before powering up, or logging onto, system. Note: if monitor does not come on (yellow power/signal indicator steady yellow on lower right corner of monitor) remove power from monitor for a few seconds, then restore and turn on monitor.

  - Start Isis with Isis H11032 shortcut – **Only**
    - This calls up a specific configuration file

- File types and locations
  - H11032 ISIS Short Cut to Start Isis Desktop
  - H11032.LAY Window Layout E:\H11032 ISIS\H11032 Config\
  - H11032_140.CFG Isis configuration file D:\TEI\IsisSona\v5.91\
  - Survey. log Isis session log D:\root
    - Note: unable to redirect this file

- Initial Processor Settings
  - File Menu

- Playback N/A
- Record Setup
    - Sonar Setup
        - Pick standard analog
        - Select CHICO/CHICO PLUS Board
            - Channel 1 edit
                - Status = On
                - Name = Port
                - Type = Port SSS
                - Trigger = 1
            - Channel 2 edit
                - Status = On
                - Name = Stbd
                - Type = Starboard SSS
                - Trigger = 1
            - All other channels disabled
            - Sonar name to H11032 Klein 595 2 CH 500Khz
            - Frequency = 384.0,384.0
            - Horizontal Beam Angle = 0.2,0.2
            - Beam Width = 50.0, 50.0
            - Tilt angle = 20.0, 20.0
            - Name of server = ISISCHICO.EXE
            - Automatic control disabled
    - Serial Port 1 Heave, Pitch, Roll
        - Status = On
        - Settings = 19200, 8, N, 1
        - Template = TSS
        - Convert Lat - Long = Disabled
        - Filter Speed = Disabled
        - Navigation Latency = 0.0
    - Serial Port 2 Not used
    - Serial Port 3 GPS for SSS
        - Status = On
        - Settings = 9600, 8, N, 1
        - Template = NMEA0183 NOCLOCK
        - Convert Lat - Long = Disabled
        - Filter Speed = Disabled
        - Navigation Latency = 0.0
    - Serial Port 4 GPS for Single Beam
        - Status = On
        - Settings = 9600, 8, N, 1

- Template = NMEA0183
  - NMEA0183 SHIPPOS NOVTG
- Convert Lat - Long = Disabled
- Filter Speed = Disabled
- Navigation Latency = 0.0

- Serial Port 5 Compass
  - Status = On
  - Settings = 4800, 8, N, 1
  - Template = NMEA0183 NOCLOCK NORMC NOGLL NOVTG
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 6 May be used for Fish Altitude input
  - Better Tuning Has Made This Option Unused
    - Manual SSS Bottom Tracking Option
    - Status = Off
    - Settings = 9600 8, N, 1
    - Template = Manual
      - Modify Default = {/100}{-1.3}7
        - Change 1.3 to value needed to get correct altitude
    - Convert Lat - Long = Disabled
    - Filter Speed = Disabled
    - Navigation Latency = 0.0
- Serial Port 7 Hypack feed for Line Control
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = (Leave Blank)
    - Allows events and start/stop info in from Hypack
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0
- Serial Port 8 448 feed to Aux Sensor 1
  - Status = On
  - Settings = 9600, 8, N, 1
  - Template = Manual
    - Modify Default = {/100}1
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled

- Navigation Latency = 0.0
- Serial Port 9 RTK INPUT

- Serial Port 10 Speed Log
  - Status = On
  - Settings = 4800, 8, N, 1
  - Template = {pattern=m}s
  - Convert Lat - Long = Disabled
  - Filter Speed = Disabled
  - Navigation Latency = 0.0

- File Format
  - Format = XTF
  - Media = Disable
  - Sample Size to Record = 16 bit
  - Samples per Channel = 1024
  - Processing Method = MAX
  - XTF File Header Notes
    - Vessel Name
    - Survey Area
    - Operator

- Configure
  - Playback Speed – as desired
    - Real Time Scrolling
      - Scroll without restoring covered data
        - This keeps system from locking up
    - Transducer Depth = 0.0
    - Ocean Tide
      - Apply Corrector = Disabled
      - Verify = 0.0
    - Sound Velocity = Average from first cast of the day
    - Multiple Pings = 1
    - Hypack DDE
      - Accept from Hypack = Disable All
      - Automatically Start Saving At Start of Line
        - Use File Name from Hypack = Enable
        - Generate File Names = Disable
        - Start Each File with = Enter Daily Directory Info
    - Cue Boxed = Disabled
    - Set Date and Time = Ignore – Will be automatically set during operation
    - Save Setup = Prompt User at Exit

- Color
  - Palette
    - SSS Colors = Grey Scale
    - Squelch = 0.0
    - Reverse Palette = Enabled
    - Strong Returns Red = Disabled
  - Grid Color
    - Voltage Grid
      - Line = Blue
      - Data = White
      - Dim = Both Enabled
    - Scale Lines Red

- View
  - Scale Lines
    - Apply Settings to = All the same
    - Scale line Unit = Distance
      - Spacing = 10
  - Depth Delay and Duration
    - Apply Settings to = All the same
    - Units = Off
  - Overlay
    - Show on Waterfall
      - Event Marks = Disabled
      - Event Text = Disabled
      - Bottom Track = Enable
    - Bookmarks
      - Save Bookmarks = Enabled
      - Display Bookmarks = Enabled
  - Down Sample = Max
  - Speed
    - Automatic = Enabled
    - Filter = Disabled
  - Heading = Automatic
  - Layback Correction
    - Apply Delta XY = Disabled
    - Apply Layback = Enable
      - Use Logged Layback = Disabled
      - Enter layback manually = Enabled

- Compute layback from Cable Out = Disabled
- Enter layback value in box provided (Currently 1.0M)
    - This field with be empty, enter value
        - Obtain value from chart
    - Click ACCEPT, current value changes to entry
    - NOTE: **DO NOT CLOSE WINDOW**
    - NOTE: CHECK AT START OF EACH LINE
    - NOTE: HAVE OPEN DURING CONTACT PICKING

- Tools
    - Target Setup
        - TargetPro.exe only
        - Target Setup
            - Height = 512
            - Width = 2048
            -
        - Target
            - File
                - **Set working Directory = Enter Daily Data Directory**
            - Tools
                - Configuration
                - Speed auto
                - Speed Corrected display = yes
                - Layback = manual
                - Horizontal beamwidth
                    - Manual, 0.0
                - Local variation = 0.00
                - Latitude/longtitude
                    - Deg Min Sec
                - Northing/Easting Display
                    - Meters
                - Range Display Units
                    - Meters
                - Speed display Units
                    - Knots
                - Misc.
                    - Automatic Audit Trail = yes
                    - Object Detection on image load
                        - None
            - Units = Meters

- Constants = Use defaults
- Set Contact Number = Start with 1 – Ensure number is consistent with contacts logged to date.
- Speed Correct = Enabled

- Parameter Window – Current File Section
  - Switch Button
    - Record Data to File Name = Blank
    - Remaining storage = Enable D: and E:
    - File Grows larger than = Disable

Altitude - Absolute

Based on 595 Range Scale

Range	8% Minimum Altitude	20% Maximum
25	2.00	5.00

Maximum System Speed

Based on 595 Ping Rate

Range	Ping Rate / Second	Maximum Speed
25	27.00	17.50

Maximum Survey Speed

Based on 10% Buffer

Range	Maximum Speed (Knots)	90 %Maximum Speed (Knots)
25	17.50	15.75

5.1.1.2 1.2.12 Robertson Autopilot

Introduction:

The factory technical representative for the parent company Simrad, is Rich Barnes (425-778-8821) who is located at Simrad, Inc., 19210 33rd Avenue West, Suite A, Lynwood, WA. 98036. The pilot was interfaced to NOAA1 to receive NMEA (modified) standard messages from Coastal Oceanographics HYPACK MAX Survey program. The vessel captain performs all operations related to the pilot.

Interface:

The pilot receives the following NMEA-0183 messages;

APB (modified by Coastal to send .#### nm of cross track error vs. .## nm, the NMEA standard)

VTG (standard)

GGA (standard)

Baud rate is 4800/N/8/1

NMEA input to the pilot is through TB 10 on the Junction Unit, Pins RX 1(+) and RX1 (-). There is no handshaking or error correction used. The Robertson RFC35R rate compass is used to provide vessel heading to all systems and outputs a NMEA message through TB10on the Junction Unit, Pins TX2(+) and TX2(-).

Operation:

The pilot starts in the **Helmsman** mode. The captain steers the vessel on to the trackline well ahead of the actual BOL and attempts to track down the line. When the vessel has stabilized online the pilot is put into the **Auto** mode. The pilot is "course steering" at this point. The captain observes the vessel motion and line tracking while adjusting the "course" using the left/right buttons on the control unit or remote control. When the vessel is steering the line and cross-track error has been reduced to a minimum (typically less than 1 meter), the captain changes to the **NAV** mode. The pilot will continue to steer in "course steering" mode for a period of time determined by an internal setting (currently at minimum – 100 sec). Then it will use the XTE value received from HYPACK MAX and attempt to adjust it's course to achieve zero XTE.

Some conditions prohibit the use of the **NAV** mode. One example is the use of a drogue chute to slow the vessel. Sea conditions that cause sudden large heading changes are another example. In these cases the pilot is left in the **Auto** mode and the left/right buttons on the control unit or remote control unit are used to con the vessel down the line.

Initial Setup:

Mechanical setup and alignment are performed at the time of installation and should require no further adjustment. There are many electronic settings that affect pilot operation. They fall in to several categories:

- Front Panel
  - Rudder – used to set the amount of rudder used by steering commands
  - Counter Rudder – used to set the opposing rudder used when crossing a course line
  - Weather – used to reduce pilot sensitivity in heavy seas
- Info Loop
- Weather Loop
- Debug Loop

Normally, only the Rudder setting is changed throughout the day. More rudder (higher #) causes closer tracking and quicker steering response. Too much rudder causes large heading swings. Too little rudder and the vessel will fail to closely follow the line.

2.0 PRE SURVEY OPERATIONS

2.1 Navigation System Check

Upon arrival in Hudson Falls a third order control disk will be located to facilitate the performance of a navigation confidence test. Two separate procedures will be performed. The first procedure is to determine the horizontal and vertical position of the project RTK GPS base station and certify it. The second procedure involves using the Trimble 7400Msi L!/L2 Kinematic OTF system to locate a check point in proximity of the survey vessel for future confidence checks.

The first procedure involves the following.

A RTK base will be set up with it's antenna positioned at a known height over a GE/QEA supplied point. The Trimble 7400Msi reference receiver is then configured to provide CMR correctors based on the following parameters.

Configuration Toolbox file D24_Base.cfg

1. Generate CMR correctors on Port 1
2. Kinematic base unit
3. A elevation mask of 13 degree's
4. A PDOP mask of 5
5. Reference position of 35 50 40.87561 Lat, 075 39 15.38597 Long, -37.75 Elev. (WGS-84 Ellipsoid height)
6. Antenna height set to 2.000 meters, Antenna mounted on a 2.00 meter rod
7. Antenna type set to L1/L2 compact resulting in a True Vertical Height of 2.062 meters

The project RTK base will be set up as a rover station, receiving corrections from the station set at various stations using the following parameters:

Configuration Toolbox file RTK_ROV.cfg

1. Receive CMR corrections on Port 1
2. Kinematic rover
3. A elevation mask of 13 degree's
4. A PDOP mask of 5
5. Output GGK on Port 2.

For reference, the RTCM-104 correctors will be relayed from the reference station to the project base station location with Pacific Crest Radio Modems Model RFM96W.

Finally, a Hypack Project will be setup to monitor the position in both WGS-84 Lat, Long and UTM Zone 18 NAD-83. The following parameters will be used.

1. Project = Base_Average
2. Kinematic DLL for GPS input configuration
3. System offsets were set to 0,0,0 for this test
4. Geodesy was set for the above listed UTM Grid.

Position observations will be recorded for a sixty minute period. These observations will then be averaged and assigned as the project RTK base stations horizontal (WGS-84 Lat Lon) and vertical elevation (WGS-84 Ellipsoid).

The project RTK base will then be set up as a reference station, sending corrections based upon the assigned position. The following parameters will be used:

Configuration Toolbox file BASE.cfg

1. Generate CMR correctors on Port 1
2. Kinematic base unit
3. A elevation mask of 8 degree's
4. A PDOP mask of 5
5. Reference position of Lat 35 50 37.98404 N , Long, 075 39 15.87987 , -23.826 Elev. (NAVD88)
6. Antenna height set to 000.00 and antenna type set to **UNKNOWN (0.0 offset)**

The data from each file will be processed through SB-MAX where it will be filtered to only GPS Mode 3 points with an HDOP of <=2.0. These values will then be averaged and also the min & max values will be observed.

2.2 Static Draft Measurement

6. Establishment of Vessel Reference Position

Prior to survey operations, a Vessel Reference Position was set for use in post processing. Survey data will be collected by an Isis v5.91 system for processing under the Caris HIPS/SIPS software package. Single beam only data will be collected by a Coastal Oceanographics HyPack MAX v0.5b system for processing under the Caris HIPS/SIPS software package. During survey operations, no physical offsets will be entered into the Isis system. Therefore, all offsets and corrections should be handled by the Caris package. It should be noted that an average sound speed for the water column and Side Scan "Horizontal Layback" will be input into the Isis raw data package. This information will be discussed in the appropriate system sections.

With this in mind the following Reference Position was established based on the definition of a Vessel Coordinate System provided in the HIPS User's Guide.

Vessel Coordinate System

Vessel configuration is based upon an instantaneous, three-dimensional, vessel coordinate system. The

Origin of the coordinate system is the reference position (RP). The axis is defined as follows:

The Y-axis is oriented along the vessel's fore/aft axis, positive forward.

The X-axis is oriented along the vessel's port/starboard axis, perpendicular to the Y-axis, positive

to starboard.

The Z-axis is perpendicular to the X-Y plane, and positive down (into the water).

The Y-axis is located approximately mid ship at the fore/aft centerline created perpendicular to the location of the A-Frame.

The X-axis is located at the approximate port/starboard center of the vessel.

The Z-axis was located at the rear deck level, slightly above the water line of the vessel during setup and sea trials

Once this point was established, measurements were made to determine the physical offsets of all survey equipment based on this coordinate system. These measurements were compiled and displayed in the AutoCAD 2000 file called R/V Willing.dwg. This drawing contains all sensor offsets.

During the establishment of system offsets a "Reference Mark" was set to aid in monitoring vessel Static Draft. The Reference Marks are located on the starboard single beam transducer mount vertical member, The distance from the Reference Mark to the Z-axis is 1.20 meters.

2.3 Monitoring Vessel Static Draft

To correctly process soundings, Caris needs to know the position of the Reference Point during survey operations. This point will move as equipment load, personnel, and fuel levels change. To compensate for these changes the Static Draft is monitored daily. At the start of every survey day the motion sensor is monitored to determine vessel attitude and a measurement is made from the Reference Mark to the present waterline. If the vessel is experiencing a roll bias, due to fuel load, personnel are moved to steady the vessel at its standard attitude. This attitude was established during sea trials, by approximating vessel loads and "zeroing" the motion sensor.

7.

8. Appling Static Draft

The measurement is logged in the daily spreadsheet and is reduced to a static draft value that is subtracted from the distance to the zero vertical reference and the difference entered in Caris.

9.

10. Static Draft Variation

The Static Draft is monitored daily as mentioned above. The Static Draft of the vessel appears to have a maximum deviation of 0.01 meters. The data to date is summarized below:

Fuel Load	Static Draft (meters)
Full	0.080
.9	0.080
.8	0.080
7	0.079
.6	0.079
.5	0.079
4	0.079
.3	0.079
.25	0.079

2.4 KTD File Development for RTK GPS Water Level Data Collection and Raw Data Collection

We will be collecting RTK GPS water level elevations throughout the survey area and will be saving them as water elevations referenced to the NAVD 88 datum. This requires the preparation and use of a .KTD file. The KTD file models the difference between the ellipsoid height and the collection datum (NAVD 88) throughout the site.

3.0 HYDROGRAPHER OPERATIONS

11.

3.1 Start of Day - System Start-up and Dock Side Checks

Upon arrival to the vessel on a planned survey day, perform the following functions or verify their occurrence. These items should be done every day before departure.

- Start generator and switch system power from shore to generator.
- If system was shut down the night before, turn on both UPS main power switches and wait for the units to power up. Trip the TEST switch once on both units to apply power to the outlets.

3.2 Start of Day – Electronics Systems Start-Up

11.1

- Verify DC Mains, 448, 595, and Autopilot are off before powering up, or logging onto, the computer systems.
- Verify that the monitors are all off via the switch on the monitor outlet strip.
- Power up the Triton Elics, NOAA 1 & NOAA 2 computers.
- Turn on the monitors via the switch on the outlet strip.
- Computer 1 & 2
  - Log on using default Logon
    - User Name osiuser
    - Password (blank)
- The Triton Elics machine is Windows 2000 and has no log on screen
- Wait for all three computer systems to fully boot
- Turn on DC Mains switch. This powers the DMS2i-05, 7400, T4000s, MX51s, CTD and radio modem
- Put the Autopilot in standby
  - Observe compass = 244 - 250 degrees

- Verify computer date/time on each system
  - Open the H11032 vessel log.xls and enter the crew arrival time, vessel departure time, and crew initials.

3.3 Start of Day - GPS Systems Check

- Activate REMCON
  - Select CLEAR to acknowledge power-up
  - Select POSITION
    - Verify Mode is RTK FIX
    - Verify position
      - Lat ~ 35 50 40.8
      - Lon ~ 75 39 19.6
- Minimize REMCON

11.1.1.1

3.4 Start of Day – Klein 595

- Check mount
- Check connector
- Check cable and lock ring
- Check Fish body screws
- Apply power to unit
- Press “any” button to start system
- Press enter once, and left arrow once to stop printer

3.5 Start of Day – Innerspace 448

- Verify paper supply in unit
- Set power to on to verify date and time – correct if necessary
- Set power back to standby
- Add Start of Day Annotation
  - Registry #
  - Julian Date
  - Calendar Date
  - Vessel
  - Transducer in use
  - Operators

- Roll #

3.6 Start of Day – EdgeTech GeoStar

- Check mount
- Check connector
- Check cable and tow line
- Check Transducer housing
- Apply power to unit

3.7 Start of Day – GSSI SIR 2000

- Check mount
- Check connector
- Check cable and tow line
- Check Transducer housing
- Apply power to unit

3.8 Start of Day – Logging

- Open Survey Log
- Log date and personnel on board
- Log WX observations at start of day
- Log activities at dock

11.2 **3.9 Start of Day – HYPACK MAX**

- Open Explorer
- Create a folders in the HYPACK/PROJECTS//DATA1/ folder with a naming scheme of ###MAX1 where ### is the Julian date of the survey day. (Daily survey directory) Create a separate folder for each survey day.
- Start Hypack MAX
    - Verify that correct Line File is Enabled

  - Verify that correct background chart is enabled
  - Verify Geodesy
- Start Survey
  - Open Dialog box under Options/Project Options
    - Set Project directory to the daily survey directory.
    - Set the Target directory to the daily survey directory.
    - Verify that the other information is correct and that Long Filenames are enabled.
  - Verify all alarms are off (except 448)
  - Verify that all equipment is in normal locations (generator, etc.)
  - Ensure vessel is in Reference position. Have vessel captain move the vessel as needed. In Survey, click on Targets, Select, and then Change File. Select the file NAVCHK.TGT from the project directory. Select the dockside nav-check point and right click on it to "select" target. Observe distance to target. If distance is excessive. (Value +/- 1.5 meters) determine what the problem is and correct it. Take a target (F5).
  - Modify the target properties (F6) to name it *XXX AM NAV CHK* where XXX is the Julian Date. Add entries in Comments section: *Pitch X.X Roll X.X Hdg XXX.X* in which you record the observed pitch, roll, and heading as observed at the dock.
  - Dockside Limits:
    - Pitch 0.0 +/- .2
    - Roll 0.0 +/- .5
    - Heading 246 +/-5 deg.
  - Evaluate if values exceed the limits.
  - Log the time in the "activity sheet" of the H11032 survey. Also, place an "x" in the roll, pitch, and heading columns on the same sheet to indicate they have been checked.

- **Dockside static draft:**
  - Observe the ROLL value from the MRU and move people to normal positions within the vessel, or as necessary to compensate for fuel load, to achieve a "zero" roll while measuring the static draft from "Reference Mark" to the water's surface. Record the measured value in survey log. Correct the measurement to true static draft value with formula provided. Also note the RTK tide displayed on the NOAA1 Hypack Max data display and enter it in the daily log sheet.
- **Dockside RTK water level check**
  - Observe the local water level reading and enter it in the RTK vs. Observed section of the daily log sheet. Compare the NAVD-88 value calculated by the log sheet with the value recorded from Hypack Max.

11.3

11.3.1.1 **3.10 Start of Day – ISIS**

- Open Windows Explorer
- Verify space unavailable on data drive E: > 10 GB. If less than 10 GB you need to clear out older (already archived) files to make space.
- Create a new directory on that drive in the H11032 ISIS folder based on the following format:
    - XXXISIS - With X = to Julian day
- Minimize Windows Explorer
- Start ISIS system from the H11032 ISIS shortcut. (This starts ISIS with the correct config file)
    - Set working directory for Isis under Configure>Hypack DDE> *Start each filename with* to daily directory
    - Set Target working directory under Tools>Target>File>Set Working Directory
- Verify next contact number is set in Tools>Target> Edit>Set Contact Number
- Set unit to Start Record to screen only- File>Start Recording>Display Only
- Set Layback—View>Layback>Enter value>Accept
- Set threshold in waterfall by right click—Threshold =1
- Set waterfall window values as shown below
- Open Sensor window- Windows>Status & Control>Sensors
- If you want to view 448 depth - Aux 1 displays depth
- Open Altitude window
- Click on symbol of Alt: in Telemetry window of Parameter Display

- **Annotations**
    - Annotations are kept in a WordPad document name JD###.TXT where ### is the Julian Date. This file is kept open on the Isis machine and annotations are copied and "pasted" into the **NOTE:** section of the .XTF.
    - SSS annotations must be recorded in the notes section of the Isis box at:
        - At start of line
        - When surface objects are noted
        - When SS tuning, range, cable out, or any other parameters are changed

4.0 CONFIDENCE CHECKS

Confidence Checks H11032-JD160-06092002-RV WILLING II/PORT

Confidence Checks H11032-JD160-06092002-RV WILLING II/STBD

Confidence Checks H11032-JD160-06092002-RV WILLING II/BOTH

Registry#/Julian Date/Calendar day/Towing Vessel/Channel

5.0 INTERFERENCE

H11032-JD160-06092002-RV WILLING II/Wake

H11032-JD160-06092002-RV WILLING II/Biologic

Registry#/Julian Date/Calendar day/Towing Vessel/Type of Interference

11.4 **6.0 DURING TRANSIT TO SITE**

- Ensure the shore power cable is stowed.
- Remove all dock lines and depart.

7.0 ON-SITE – PRIOR TO SURVEYING

- Determine sound velocity and enter into machines
- Isis – **Configure/Sound Velocity**
- Hypack Max – **Options/Navigation/Roxann Sound Velocity**
- Innerspace 448 – Dial in as **Speed of Sound**
- Bar Check
- Depth confidence check
- Deploy SSS for appropriate tow
- Check SSS Range

11.4.1

7.1 Daily Average Speed of Sound

- Obtain speed of sound readings. Enter in 448, Isis, and in HYPACK MAX - Survey, under OPTIONS, Navigation Parameters as "Roxann Sound Vel. Verify value is representative of prior values.

11.4.2 7.2 BAR Check (Depth)

- Verify that the average speed of sound from the days first cast is entered into the 448
- Lower the barcheck to the lowest 1.0 meter increment available referencing the 1 meter marks to the 448 draft mark on the transducer vertical pole.
- Start the 448 paper and record the bar at one meter intervals to 1.0 meters.

11.4.3 7.3 Confidence Check (Depth)

- Check 448 to insure correct sound velocity entered, draft=0.0, tide=0. Mode Auto, gate 4, replies 8. Turn 448 from STBY to ON just prior to check to record date, time, speed of sound, and draft on paper record.
- Record depth on paper record as Hydrographer lowers bar to seafloor. On the "MARK" given by the hydrographer as the bar is touching the seafloor, toggle the FIX MARK switch on the 448. The hydrographer will measure the distance from the seafloor to the water surface using the barcheck marks and by measuring between marks. Take target.(F5) Name target XXX Depth Confidence Check. Return 448 to STBY mode.
- Annotate paper record with:
  - Depth Confidence Check
  - H11032
  - Julian Date XXX
  - Operator Initials
  - Bar Check = X.X m (meters)
  - Calculated 448 depth by adding displayed depth to daily static draft.

7.4 Confidence Check (Sidescan)

- While collecting data:

- ISIS operator will enter the appropriate annotation into the **NOTE:** section of the .XTF while online. The time is entered into the daily log and noted as a confidence check .
- At times other than during regular data collection
- A line can be run outside of regular data collection to demonstrate that the sidescan sonar system is able to detect targets out to the full extent of the selected range. The Hypack operator selects line 900 to record the data. The XTE value in *Survey/Options/Navigation Parameters* should be changed to 200000 to avoid unnecessary TEXT log entries. Start the line when ISIS is ready.

11.4.4

11.4.5 **8.0 BEFORE ON LINE DATA COLLECTION**

8.1 Computer 1 - Hypack Max

Start Survey

Verify correct line entered, and line azimuth is correct. Change if necessary.

8.2 Computer 2 - Hypack Max

Start Survey – start logging prior to BOL.

8.3 Innerspace 448

Turn 448 alarms on (if off) – verify digital depth is ok Start Paper

8.4 ISIS

Verify ISIS is ready.

8.5 Heave

Verify Heave is ready.

Create a target (F5) and change it's properties (F6) to DECK CTD = XXXX.X. (The value observed at the beginning of line)

9.0 START OF LINE

- Save / Clear any contacts in the Target window
- Verify SSS data quality and bottom track prior to start
- Verify coastal line start of Isis
    - Watch file size increment
    - Check destination directory for file

11.5 10.0 ONLINE

Observe digital depths, heave, and profile window to verify proper operation. In shallow areas assist the vessel helmsman by closely monitoring the depth of water. Immediately notify helmsman of hazardous condition. Watch water depth to QA/QC alt. of SSS. Watch vessel speed.

Observe Sidescan record in Isis. Mark targets & put target in Hypack so as to allow checking the target on the next pass.

Periodically observe Deck CTD value, DIM value, heave, vessel speed, and CTD time interval. Observe Navigation map for holes in Isis.

11.5.1 10.1 Gap Tracking - Sidescan

If a condition is observed that may create a gap in the Sidescan data the operator hits F5 on Computer 1 to create target. The operator then evaluates further. If a gap is declared the target will be called up for modification (F6). The default name in the target name field will be changed to

XXX SS GAP; where XXX is the julian date. Further info will be entered into the notes field as follows:

Start & end time of gap, channel (port/stbd) Line designation

Example:

034 SS GAP

Notes: 16:37:00 to 16:37:45, Port Channel, Line 201_1549.034, type of interference

Ensure that Gap is entered in H11032 daily log.

10.2 Gap Tracking - Singlebeam

Hypack operator hits F5 and creates a target as SB gap is seen. Operator modifies target (F6) to change name to XXX SB GAP. (XXX is the Julian date) Ensure that Gap is entered in survey daily log file.

12. 11.0 END OF LINE

- Save all contacts as follows, and report final contact number in log
  - Target>File>Save All>Yes if not saved already

12.0 END OF DAY

Review ASCII text file for alarms

12.1 End Of Day - ISIS

- Exit from Isis
- Close Target window if still active
- Log off machine or shut down based on required backup situation

12.2 Archiving Procedure

- Data from all sources is colleted in Computer 1archive for archiving and data transmittal preparation
- A separate directory is established for each survey day with a subdirectory structure where each type of data is stored
- The structure and file types are outlines below

DIRECTORY NAME		FILE NAMES	
XXX Data\Docs	All documents created	H11032 Survey Log.XLS	Summary of all activities
		Willing II_offsets_1_19.DWG	Vessel layout and system offsets
XXX Data\XXXisis	All Isis data files	*.XTF XXX.LOG *.CON, XXX-00-contact.TXT	All .XTF files from the day Daily Isis survey log Original Isis contact files
XXX Data\Max_Support	Hypack MAX support files	Varied file types	Setup and support files for Hypack MAX operation Hypack MAX operations and alarms summary

			.INI files used for MAX
XXX Data\XXXmax1	Hypack MAX data files and .log file	*.RAW *.TGT	All Hypack data lines .TGT is MAX target file

- A directory template is available with all subdirectories established with an XXX, copy this template to Computer 1 and replace XXX with Julian day.
- Removable Hard Drive
  - A copy of each days data are copied from Computer 1 to a removable hard drive at the end of each survey day.
  - The Drive is then taken to the project office where the data is archived.
- XTF Data
  - Move the survey log from D:\root to daily directory at the end of the survey day
- Hypack Data
  - Copy both the TGT and the TXT file for the day to the data archive.
- Document Files
  - Copy the Daily Survey Log to the Daily Directory Doc section
  - Copy the Master Log.XLS to the Daily Directory Doc section
  - Copy any other relevant documents or drawings to this section
- Misc Section
  - Place any other non-standard files into this directory.

13. 12.3 End of Day: System Shut Down and Dock Side Checks

Upon arrival at the dock, perform the following functions or verify their occurrence. These items should be done every day before departure from the vessel.

- Secure all dock lines and hook up the shore power cable upon arrival at the dock, log arrival time in vessel log.
- Read the vessel fuel gauge and enter the value in “Activities Section” of Daily Log
- Capacity is approximately 120 gallons

- Ensure vessel has all appropriate supplies for the next day. Fuel, disks, FEDEX supplies, food, paper supplies, and water.
- Switch the system over to shore power after verify unneeded systems are off.
- Turn off the DC Mains and Autopilot.
- Verify you have the Data package and any files that will be e-mailed with you.
- Ensure all lights and boat electronics are off. Check all windows. Ensure bilge pumps are on. Lock back door upon departure.

12.4 Misc. System Operations

13.1.1.1

13.1.1.2 **12.4.1 Klein 595**

- Lower fish into the water to test operation

- Deploy fish and note cable out for layback calculations.
- Verify SSS image quality on Isis

- End of Day
  - Power Off
  - Recover Fish
  - Inspect entire wet end of system for wear – damage

13.1.1.2.1.1 **12.4.2 Innerspace 448**

- On-site
  - Input average speed of sound from first SVP and verify entry into all other systems
    - 448 – Hypack – Isis
- Start of Line
  - Alarm on
    - Good bottom lock
  - Verify range, gain, mode, and gate settings for upcoming line conditions.
  - Verify proper sound velocity based on first cast

- Unit in standby power unless performing confidence check or time check

- End of day
  - Turn unit off
  - Remove and archive sounding roll
  - Verify Sounding pole is raised
  - Verify paper supply on board

- Periodic Maintenance
  - Clean print head

12.4.3 EdgeTech GeoStar subbottom profiling system

- End of Day
  - Power Off
  - Recover Transducer

  Inspect entire wet end of system for wear – damage

12.4.4 GSSI SIR 2000 ground penetrating radar system

- End of Day
  - Power Off
  - Recover Antenna

  Inspect entire wet end of system for wear – damage

APPENDIX 4

STANDARD OPERATING PROCEDURES FOR SEDIMENT PROBING

1. Using the on-board GPS system, maneuver the sampling vessel to within 5 ft of the pre-programmed target coordinates for each sample location. Secure the vessel in place using spuds and/or anchors.

2. Use a 3/8 in. steel rod or equivalent to probe the sediment. The probe will be sharpened at one end, and calibrated in 6 in. intervals.

3. Probing will be conducted a minimum of 3 - 5 ft away from the target core location to avoid disturbing the sediment at the sampling location.

4. Advance the probe into the river bed, noting the depth of penetration and type of resistance met by the probe.

5. Move the probe laterally several feet (while maintaining the minimum 3 ft distance from the target core location) and repeat the probing at least 3 times.

6. Record the approximate average sediment thickness (to the nearest 1/2 ft.) and estimated sediment type (e.g., rock, fine-grained, coarse-grained) in the field log. If results of probing are inconsistent between the three attempts; record the inconsistency in the manual description of the field database. Record the estimated sediment type as the most representative one of the three attempts.

7. Prepare to collect a core in accordance with the procedures specified in the Sediment Core Collection SOP.

APPENDIX 5

STANDARD OPERATING PROCEDURE (SOP) GEHR8082

1.0 Title: General Electric (GE) Hudson River Design Support Sediment Sampling and Analysis Program Standard Operating Procedure for the analysis of Polychlorinated Biphenyls (PCBs) by SW-846 Method 8082

Capillary Column

Standard operating procedure for the analysis of Polychlorinated Biphenyls by Gas Chromatography with Electron Capture Detection and Total Aroclor Quantification.

(Acknowledgment: This SOP is based substantially on internal method SOPs provided by Northeast Analytical, Inc. of Schenectady, N.Y.)

2.0 Purpose

The purpose of this SOP is to provide a detailed written document for measurement of Polychlorinated Biphenyls (PCBs) according to SW-846 Method 8082 specifications.

3.0 Scope

3.1 This SOP is applicable to the determination and quantification of PCBs as outlined in EPA SW-846 Method 8082 for the GE Hudson River Design Support Sediment Sampling and Analysis Program. It is applicable to the sediment/solid samples.

3.2 The following compounds can be determined by this method:

Compound	CAS Number
Aroclor-1016	12674-11-2
Aroclor-1221	11104-28-2
Aroclor-1232	11141-16-5
Aroclor-1242	53469-21-9
Aroclor-1248	12672-29-6
Aroclor-1254	11097-69-1
Aroclor-1260	11096-82-5

3.3 In general, samples are extracted, with a pesticide-grade solvent. The extracts are further processed by concentrating or diluting, depending on the PCB concentration, and carried through a series of clean-up techniques. The sample is then analyzed by injecting the extract onto a gas chromatographic system and detected by an electron capture detector.

3.4 This SOP provides detailed instructions for gas chromatographic conditions, calibration, and analysis of PCBs by gas chromatography. Sediment extraction procedures are covered in separate standard operating procedures.

4.0 Comments

4.1 One of the major sources of interference in the analysis of PCBs is that organochlorine pesticides are co-extracted from the samples. Several of the commonly found pesticides and associated degradation products (DDT, DDE, DDD) overlap the PCB profile envelope and co-elute with several PCB GC peaks and therefore cannot be accurately measured. The analyst must be careful in chromatographic pattern review and flag peaks that are suspected

of being contaminated so that they are not included in the total PCB values generated.

4.2 Laboratory contamination can occur by introduction of plasticizers (phthalate esters) into the samples through the use of flexible tubing. Samples and extracts should not be exposed to plastic materials. Phthalate esters respond on electron capture detectors, usually as late eluting peaks, and can interfere in PCB quantification.

5.0 Safety

5.1 Safety glasses and disposable gloves must be worn when handling samples and extracts.

5.2 All manipulations of sample extracts should be conducted inside a chemical fume hood. The analyst should minimize manipulation of sample extracts outside of a fume hood.

5.3 Safe laboratory practices should be followed by the analyst at all times when conducting work in the lab. The analyst should refer to the reference file of material safety data sheets to familiarize themselves with the precautions of handling applicable solvents and chemicals used to process samples. The analyst should refer to the project laboratory's internal chemical hygiene plan for further safety information.

5.4 Samples remaining after analysis should be disposed of through the project laboratory's internal disposal plan. Refer to the project laboratory's internal standard operating procedures for disposal of laboratory waste.

6.0 Requirements

6.1 Extensive knowledge of this standard operating procedure and SW-846 Method 8082 is required.

6.2 The analysis portion of this method should be performed by a skilled chemist or by an analyst trained in the quantification of trace organics by gas chromatography.

7.0 Equipment

7.1 Instrumentation

7.1.1 Gas chromatograph: Varian Model 3400 or equivalent, equipped with Model 1077 split/splitless injector or equivalent, temperature programmable oven, electron capture detector, and Model 8100 autosampler or equivalent.

7.1.1.1 Column - A 30 meter, 0.25 mm ID, 0.25-micron phase DB-1 capillary column is used for analysis.

7.1.2 Chromatographic Data System: A data system for measuring peak height and peak area. A Millennium_32 computer network based workstation (Waters Associates) or equivalent, will be employed to capture detector response and digitally store the chromatographic information. This system will allow for chromatographic review of data from the gas chromatograph, electronic peak integration for precise calculations, database structuring of the analytical information, and archival capabilities.

7.2 Glassware and Accessories

7.2.1 25-mL volumetric flasks, Class A, (Baxter Cat. No. F4635-25 or equivalent)

7.2.2 5-mL volumetric flasks, Class A, (Baxter Cat. No. F4635-5 or equivalent)

7.2.3 10-mL volumetric flasks, Class A, (Baxter Cat. No. F4635-10 or equivalent)

7.2.4 50-mL volumetric flasks, Class A, (Baxter Cat. No. F4635-50 or equivalent)

7.2.5 100-mL volumetric flasks, Class A, (Baxter Cat. No. F4635-100 or equivalent)

7.2.6 4-dram vials for sample extract storage (Kimble Opticlear, part no. 60910, code no. 60910-4 or equivalent)

7.2.7 8-dram vials for sample extract storage (Kimble Opticlear, part no. 60910, code no. 60910-8 or equivalent)

7.2.8 Pasteur pipettes (Kimble, part no. 72050 or equivalent)

7.2.9 250-mL beakers, glass (Baxter Cat. No. B2650-250 or equivalent)

7.2.10 100-mL beakers, glass (Baxter Cat. No. B2650-100 or equivalent)

7.2.11 Disposable 10-mL pipettes (Baxter P4650-110 or equivalent)

7.2.12 Disposable 5-mL pipettes (Baxter P4650-15 or equivalent)

7.2.13 Disposable 1.0-mL pipette (Baxter P4650-11X or equivalent)

7.3 Chemicals

7.3.1 Pesticide-Grade Hexane, Burdick and Jackson, (Cat. No. 216-4) or equivalent

7.3.2 Pesticide-Grade Acetone, Burdick and Jackson, (Cat.No.010-4) or equivalent

7.3.3 Pesticide-Grade Toluene, Baker, (Cat. No. 9336-03) or equivalent

7.3.4 Pesticide-Grade Methylene Chloride, Burdick and Jackson, (Cat. No. 300-4) or equivalent

7.4 Analytical Standard Solutions

7.4.1 Aroclor Stock Standard Solutions

7.4.1.1 Polychlorinated Biphenyls - Neat commercial material for standard preparation. These materials are multi-component mixtures of PCB congeners and are the actual materials that were used in products such as electric power transformers and capacitors. Commercially-prepared stock standards can be used if they are certified by the manufacturer or by an independent source and traceable to National Standards of Measurement.

7.4.1.2 Stock standards are prepared from individual Aroclor formulations by weighing an exact amount of the neat material to the nearest 0.1 mg, and dissolving and diluting to volume in a 100 mL volumetric flask with hexane. See Attachment A, Table 1 for an example of exact weights of each compound. For decachlorobiphenyl (DCB), dissolve

neat formulation in 10 mL of toluene and then transfer to a 100 mL volumetric flask bringing to volume with hexane. Alternatively, commercially-prepared stock standards may be used providing they are traceable to National Standards of Measurement.

7.4.1.3 The stock standards are transferred into Boston bottles and stored in a refrigerator at 0-6°C, protected from light.

7.4.1.4 Stock PCB standards must be replaced after one year, or sooner if comparison with certified check standards indicate a problem. See 8.5.3 for limits.

7.4.1.5 The labeling and tracking of standards should be in accordance with the project laboratory's internal standard operating procedures for preparation of standards. Labeling of standards should also be in accordance with NELAC standards, section 5.10.5.

7.4.2 Calibration Standards

7.4.2.1 Calibration standards are prepared at five concentration levels using a prepared working standard. See Attachment A, Table 2 for an example of the preparation and exact concentrations of the working standards. The following five standards make

up the initial calibration curve standard set for each of Aroclor-1221, Aroclor-1242, and Aroclor-1254: 20 ng/mL, 100 ng/mL, 250 ng/mL, 500 ng/mL, and 1000 ng/mL. One calibration standard at 50 ng/mL which is below the reporting limit (80 ng/mL) will be prepared for each of Aroclor-1016, Aroclor-1232, Aroclor-1248, and Aroclor-1260 (unless observed to be present in a project sample which would require recalibration for the detected Aroclor at the five standard levels used for Aroclor-1221, Aroclor-1242, and Aroclor-1254).

7.4.2.2 The two surrogates tetrachloro-*meta*-xylene (TCMX) and DCB are included in the Aroclor-1254 calibration standards. The stock standard for TCMX is prepared by diluting 1 mL of TCMX solution (ULTRA, cat. #IST-440 or equivalent, at 2000 μg/mL) into a 100-mL volumetric flask resulting in a solution of TCMX at 20 ppm.

7.4.2.3 To prepare the working surrogate standard, pipet 5.0 mL of the 100ppm DCB stock standard and 2.5 mL of the 20 ppm TCMX stock standard into a 100 mL volumetric flask and bring to volume with hexane. The final concentration of this solution will be 5.0 ppm of DCB and 0.5 ppm of TCMX.

7.4.2.4 Refer to Attachment A, Table 4 for an example of the instructions on preparation of the calibration standards

containing Aroclor-1254 and the surrogates. Refer to Attachment A, Table 3 for an example of the instructions on preparing the remaining calibration standards.

7.4.2.5 Transfer all calibration standards to 8-dram vials (or equivalent) and store in a refrigerator at 0-6°C, protected from light. Calibration standards must be replaced after six months, or sooner, if comparison with check standards indicates a problem. See 8.5.3 for acceptance limits.

7.4.3 Continuing Calibration Check Standards

7.4.3.1 Continuing calibration check standards are prepared independently from calibration standards, by using an alternate source purchased from standard vendors. Continuing calibration check standards will be prepared for Aroclor-1221, Aroclor-1242, and Aroclor-1254 (and other Aroclors, if detected). All continuing calibration check standards will contain the surrogate compounds TCMX and DCB. Refer to Attachment B, Tables 1-3 for instructions on preparation of these standards.

8.0 Procedure

8.1 Gas Chromatographic Operating Conditions

8.1.1 Establish the gas chromatograph (GC) operating parameters as follows:

Autosampler parameters: Multi-vial mode, ECD Attenuation and range are 1.

Refer to Attachment C for all other GC operating procedures.

Note: GC helium gas flow is optimized after instrument maintenance by adjusting nitrogen flow to elute a PCB calibration standard to a known retention time.

8.2 Data Acquisition

8.2.1 Chromatographic information will be collected and processed utilizing a computer based data acquisition workstation (Waters Associates, Millennium_32 computer network based workstation or equivalent). The GC workstation acquires the millivolt detector signal, performs an analog to digital conversion and stores the digital chromatogram on the computer network's disk. The chromatography software performs all data reduction including, long term data storage on magnetic media, chromatographic peak integration, all calculations, report generation, chromatogram plots, and calibration functions.

8.3 Initial GC Calibration

8.3.1 GC calibration will be performed by the external calibration procedure. Prior to running samples the system must be calibrated and system performance must be verified.

8.3.2 Establish the gas chromatographic operating parameters outlined in Section 8.1. Five calibration standard levels are to be prepared for each Aroclor-1221, Aroclor-1242, and Arclor-1254 and the surrogate compounds TCMX and DCB and one calibration standard level (at 50 ng/mL) is to be prepared initially for each Aroclor-1016, Aroclor-1232, Aroclor-1248 and Aroclor-1260 as discussed in section 7.4.2. If Aroclor-1016, Aroclor-1232, Aroclor-1248 or Aroclor-1260 is detected in any project sample based on the single-point calibration, the affected samples must be reanalyzed after a five-point calibration for the detected Aroclor.

8.3.3 Inject each calibration standard using the GC autosampler and the parameters outlined in section 8.1, which are those used for actual samples.

8.3.4 For each Aroclor, 5 peaks are selected to prepare calibration curves (or calibration factor for single-point calibrations). The peaks selected from the multi-component Aroclor formulations were based on maximizing the separation for each Aroclor (*i.e.*, minimizing peak overlap in retention time). Consideration was also given to selecting peaks that normally did not have problems with co-elution with interfering peaks or possible co-elution with

organochlorine pesticides. The determined area of the five peaks selected for calibration is processed by the data workstation as a group, combining the area for calculations of the calibration factors. The following table lists the Aroclors that are included in the initial calibration and group number that represents the group of peaks selected for that Aroclor for calibration purpose.

Aroclor	Group Number
A1221	1
A1232	2
A1016	3

Aroclor	Group Number
A1242	4
A1248	5
A1254	6
A1260	7

8.3.5 Attachment D is an example of chromatograms of standards of each Aroclor for a DB-1 column with peaks selected for calibration labeled.

8.3.6 For the initial calibration curve to be considered valid, the percent relative standard deviation must be less than 20% over the working range. In addition, the correlation coefficient for the linear calibration curve must be greater than or equal to 0.99. The linear-fit calibration curve (not forced

through zero) is used for quantification in every case and is not replaced with the average calibration factor.

8.4 Retention Time Windows

8.4.1 The GC system should be checked by the analyst to make sure it is functioning properly before establishing retention time windows. Make three injections of each Aroclor at a mid-level concentration throughout a minimum 72-hour time period.

8.4.2 For the 5 peaks selected for calibration of each Aroclor, calculate the standard deviation resulting from the variation in the three retention times for that peak.

8.4.3 The retention time window is defined as plus or minus three times the standard deviation of the three retention time determinations.

8.4.4 If the standard deviation of the selected peak is zero, the standard deviation of the peak eluting after it is used. If it is the last eluting peak that has zero for the standard deviation, then substitute the standard deviation of the peak eluting before the last peak.

8.4.5 Retention time (R.T.) windows established in section 8.4.3 to 8.4.4 may not be practical when samples containing matrix interferences are injected onto the GC column. The default R.T. window of ± 0.08 minutes is employed

when the established windows are below ±0.08 minutes. Besides using retention time windows to assign peaks for quantification, the analyst should rely on their experience in pattern recognition of multi-response chromatographic response exhibited by PCB Aroclors.

8.4.6 Attachment E provides examples of calculated retention time windows generated by the above outlined procedures.

8.5 Gas Chromatographic Analysis

8.5.1 Prior to conducting any analyses on samples, calibrate the system as specified in Section 8.3

8.5.2 To start an analytical sequence, the 500 ppb calibration standard is injected and analyzed for the Aroclor-1221, Aroclor-1242, and Aroclor-1254 after the initial calibration and if more than 24-hours has elapsed since the last valid continuing calibration check standard. If less than 24-hours has elapsed since the last valid continuing calibration check standard, select one 500 ppb continuing calibration check standard (Aroclor-1221, Aroclor-1242, or Aroclor-1254, each containing the surrogate compounds TCMX and DCB). Selection of continuing calibration check standards other than Aroclor-1221, Aroclor-1242, or Aroclor-1254 should be based on anticipated Aroclor contamination that the samples may exhibit. Selection of the continuing calibration check standard after the start of a sequence should also be alternated among the three Aroclors.

8.5.3 The calculated value for each Aroclor and surrogate in the continuing calibration check standard must be ±15% of the true value for it to be valid and analysis to proceed. If this criterion is exceeded, the analyst should inspect the system to determine the cause and perform maintenance as necessary. The system can then be recalibrated and sample analysis can proceed. **Note:** If a failed continuing calibration check returns to acceptable calibration later in the sequence, samples following the acceptable continuing calibration check will be reported; and samples between the failed continuing calibration check and subsequent compliant continuing calibration check will be reanalyzed. All samples which are not bracketed by valid continuing calibration check standards must be reanalyzed when the system is in-control. The analytical sequence must end with the analysis of the CCCs for each Aroclors-1221, -1242, and -1254 (and/or other Aroclors if to be quantitated).

8.5.4 The daily retention time windows must be established. Use the retention time for the selected 5 peaks of the continuing calibration check standard as the midpoint of the window for that day. If all seven Aroclors were analyzed as the initial calibration or continuing calibration check standard, then establish retention time windows using the retention time plus or minus the windows established in Section 8.4. If not all Aroclors were analyzed as the initial calibration or continuing calibration check standard, use the retention time from these Aroclor standard(s) as the midpoint plus or minus the windows established in Section 8.4 to establish the daily retention time windows. For

the remaining Aroclors, go back to the previous time the remaining Aroclors were analyzed as the initial or continuing calibration check standards in the past 24 hours and use those retention times plus or minus the windows established in Section 8.4 to develop daily retention time windows. If greater than 24 hours have elapsed since a particular Aroclor was analyzed as part of the initial or continuing calibration check, the daily retention time window for that Aroclor will be updated by reference to the surrogate or Aroclor continuing calibration check shift(s).

8.5.6 Each Aroclor and surrogate in all succeeding continuing calibration check standards analyzed during an analysis sequence must also have a percent difference of 15% or less when compared to the initial calibration generated from the 5-point calibration curve.

8.5.7 All succeeding standards in an analysis sequence should exhibit retention times that fall within the daily retention time window established by the first continuing calibration check standard(s) of that analytical sequence. If the retention times are outside the established windows instrument maintenance must be performed and recalibration may be required.

8.5.8 The following is the order that initial calibration standards, continuing calibration check standards, method blanks, QC samples, and samples are placed in an analytical sequence. A continuing calibration check standard is run after every ten injections in the analytical sequence. All analytical

sequences must end with a continuing calibration check standard regardless of the number of samples analyzed.

ANALYTICAL SEQUENCE

INJECTION	MATERIAL INJECTED
1	Hexane Blank
2-20	Initial Calibration Standards
21-23	Continuing Calibration Check Standards (Aroclor-1221, Aroclor-1242, and Aroclor-1254 and other Aroclors if reanalysis occurs if other Aroclors were observed in the samples)
24-33	Sample analyses, including method blanks, matrix spikes, matrix spike duplicates, and QC reference check standard (LCS). A maximum of 10 samples between continuing calibration check standards.
34	Continuing calibration check standard

ANALYTICAL SEQUENCE (CONTINUED)

INJECTION	MATERIAL INJECTED
45 and higher	Repeat inject. 24-34 sequence (Alternating continuing calibration check standards between Aroclor-1221, Aroclor-1242, and Aroclor-1254 and other Aroclors [reanalysis occurs if other Aroclors were observed in the samples])
Closing injections:	Continuing calibration check standards (Aroclor-1221, Aroclor-1242, and Aroclor-1254 and other Aroclors [reanalysis occurs if other Aroclors were observed in the samples])

8.6 Quality Control (Refer to Attachment F for a summary of the quality control requirements.)

8.6.1 This section outlines the necessary quality control samples that need to be instituted at the time of sample extraction. The data from these quality control samples is maintained to document the quality of the data generated.

8.6.2 Each analyst must demonstrate competence in accuracy and precision on quality control samples before beginning analysis on samples. This demonstration must be on-going and be repeated if there is any modification to the method.

8.6.3 With each batch of samples to be extracted a method blank is processed. The method blank is carried through all stages of sample preparation and measurement steps. For sediment/solid samples, a laboratory sodium sulfate blank is processed.

8.6.4 The method blank must exhibit PCB levels less than the matrix-defined reporting limit. If the method blank exhibits PCB contamination above the reporting limit, the samples associated with the contaminated blank should be re-extracted and analysis repeated. If there is no original sample available for re-extraction, then the results should be flagged with a "B" indicating blank contamination. The value measured in the blank is reported for those samples associated with the particular blank out of criteria.

8.6.5 At this time, the GE Hudson River Design Support Sediment Sampling and Analysis Program does not require the preparation and analysis of matrix spike and/or matrix spike duplicate samples. If requested in the future, a matrix spike for Aroclor-1242 is to be analyzed at a rate of 1 matrix spike per every 20 samples at a concentration of 20,000 ng/mL in the extract (**Note:** this spike concentration will require a sample dilution to be performed). Also a matrix spike duplicate sample is to be analyzed at a rate of 1 per every 20 samples.

8.6.6 If requested, analyze one unspiked and two spiked samples. Calculate the percent recovery based on Aroclor concentration of both samples as follows:

A = concentration of spiked sample
B = concentration of unspiked sample (background)
T = known true value of the spike

Percent Recovery (p) = 100 (A-B) %/T

Compare the percent recovery calculated with the project limits of 60-140%. If the concentrations of the matrix spikes are *greater* than four times the calculated sample amount then the quality control limits should be applied. If the concentrations of the matrix spikes are *less* than four times the sample than there are no established limits applicable. If the percent recovery falls outside the acceptance range for the given Aroclor used as the spiking analyte, then the matrix spike recovery failed the acceptance criteria. Check for documentable errors (*e.g.,* calculations and spike preparations) and then check the unspiked sample results and surrogate recoveries for indications of matrix effects. If no errors are found and the associated QC reference check standard (Laboratory Control Sample [LCS]) is within 60-140%, then sample matrix effects are the most likely cause. Note this in the Case Narrative.

A relative percent difference (RPD) must also be calculated on the matrix spike set recoveries. This is calculated as follows:

A = % recovery of matrix spike sample
B = % recovery of matrix spike duplicate sample

RPD = [(A-B)/{(A+B)/2}] x 100
where (A-B) *is taken as an absolute value*

If the concentrations of the matrix spike set are *greater* than four times the calculated sample amount, then an RPD of 40% or less is acceptable. If the concentrations of the matrix spike set are *less* than four times the calculated sample amount than there are no established limits applicable to the RPD. If the criterion is not met, check for documentable errors (*e.g.,* calculations and spike preparations) and then check the unspiked sample results and surrogate recoveries for indications of matrix effects. If no errors are found and the associated LCS is within 60-140%, then sample matrix effects are the most likely cause. Note this in the Case Narrative.

8.6.7 A QC reference check standard (LCS) is also prepared and analyzed for Aroclor-1242 at a concentration of 500 ng/mL in the extract. For sediment/solid samples, sodium sulfate is used for the QC reference check standard (LCS). Calculate the percent recovery for the Aroclor spike and compare to the project limits of 60-140%. If the percent recovery for the QC reference check standard (LCS) is out of criteria, the analysis is out of the control for that analyte and the problem should be immediately corrected. The entire batch of samples will need to be re-extracted and re-run (Exception: If the LCS recovery is high and there were no associated positive results for any Aroclor, then address the issue in the Case Narrative and no further action is needed).

8.6.8 Surrogate compounds are added to each sample, matrix spike, matrix spike duplicate, method blank, and QC reference check standard (LCS) at time of extraction. The surrogate compounds TCMX and DCB are to be added prior to extraction for final extract concentrations of 10 ng/mL and 100 ng/mL, respectively (refer to extraction SOPs).

8.6.9 Only one surrogate analyte needs to meet established control limits for the analysis to be valid. For samples analyzed at a five-fold dilution of the extract or less, the data is compared to the project limits of 60-140%. If percent surrogate recovery is not within limits for either surrogate, the following steps are required.

8.6.9.1 Review calculations that were used to generate surrogate percent recovery values to make certain there are no errors.

8.6.9.2 Check by GC analysis surrogate solutions used during sample extraction steps to ensure that no problems exist with spiking solutions.

8.6.9.3 Re-analyze the extracts that did not meet control limits at the previously analyzed dilution to assess if the sample matrix interfered with surrogate measurement.

8.6.9.4 If the above steps do not give satisfactory results, re-extract and re-analyze the sample. Report this data if surrogate recovery is within limits. If surrogate percent recovery is out of limits for the re-extracted samples, low or high surrogate recovery is due to matrix affects and the data can be reported as estimated and the data user is notified in the form of a case narrative.

8.7 Qualitative/Quantitative Issues

8.7.1 Quantitation of Aroclors is complex. In each case, the Aroclor is made up of numerous compounds and, consequently, the chromatograms are multi-peak; also, in each case, the chromatogram of the residue may not match that of the standard. These residues are quantitated by comparison to one or more of the Aroclor mixtures, depending on the chromatographic pattern of the

residue. A choice must be made as to which Aroclor or mixture of Aroclors will produce a chromatogram most similar to that of the residue.

8.7.2 If Aroclors-1016, -1232, -1248, and/or -1260 are detected in a project sample, the instrument must be calibrated using 5 concentration levels (20 ng/mL, 100 ng/mL, 250 ng/mL, 500 ng/mL, and 1000 ng/mL) for the detected Aroclor(s) and the sample reanalyzed for quantitation by a 5-point linear fit calibration curve. The same acceptance criteria that applied to initial calibration and continuing calibration check standard analysis for Aroclors -1221, -1242, and -1254 will apply to Aroclors-1016, -1232, -1248, and/or -1260 when samples are reanalyzed for quantitation of any of these Aroclors.

8.7.3 All quantitations are to be based on 5-point initial calibrations (using external standard calibration techniques). The concentration of each Aroclor and surrogate in the sample will be determined by using the linear-fit calibration curve (see section 8.7.5) determined from the initial calibration standards. Refer to section 8.3 for initial calibration procedures. The final calculated sample concentration will take into account the sample-specific dilution factor, initial sample weight, final extract volume, and percent solids. All solids will be reported on a dry-weight basis.

8.7.4 If the instrument level of any Aroclor in a sample exceeds the instrument level of that Aroclor in the highest level standard, the sample must be diluted to approximately mid-level of the calibration range and reanalyzed for quantitation.

8.7.5 Calibration Curve by First Order Linear Regression External Standard Calibration.

Five selected Aroclor quantitation peaks are calibrated by first order linear regression with intercept. The surrogates TCMX and DCB are calibrated and quantified in the same manner using the individual peak areas for these analytes:

Equation of Line: $Y = aX + b$

where:

Y = summed total peak area of quantitation peaks used (uV-sec)
a = coefficient constant (slope)
X = calibration concentration (ng/mL)
b = first order coefficient (intercept)

8.7.6 Sample Concentration result calculation (solid samples)

$$C = \frac{(Y_i - b) * V_e * df}{a * M * \%TS * 1000}$$

where:

C = sample concentration (μg/g)
Y_i = summed total area of quantitation peaks in sample. (uV-sec)
b = intercept from (#1 above) (uV-sec)
V_e = concentrated extract volume (mL)
df = analytical dilution factor of extract
a = slope (from #1 above)
M = mass of sample in (g)
%TS = Percent Total Solid (in decimal format)
1000 = units conversion ng to μg

9.0 References

9.1 U.S. EPA SW-846 "Test Methods for Evaluating Solid Waste; Volume 1B Laboratory Manual Physical/Chemical Methods", Office of Solid Waste and Emergency Response, Third Edition, Final Update, December 1996.

9.2 U.S. EPA 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants", July 1988.

9.3 New York State Department of Health, "Environmental Laboratory Approval Program Certification Manual", Wadsworth Center for laboratories and Research, 1988, updated 1998.

9.4 "Guide to Environmental Analytical Methods", fourth edition, Genium Publishing Corporation, 1998.

10.0 Attachments (**Note:** Attachments are not paginated.)

10.1 Attachment A: Example PCB Standards Preparation Tables

10.2 Attachment B: PCB Continuing Calibration Tables

10.3 Attachment C: Gas Chromatograph Operating Procedures

10.4 Attachment D: Chromatograms of PCB standards.

10.5 Attachment E: Retention Time Windows

10.6 Attachment F: Quality Control Requirements Summary Table for SOP GEH8082

ATTACHMENT A

Table 1
Example PCB Stock Standard Preparation Table

PCB Formulation	Supplier	Catalog #	Std. weight (mg)	Conc.(PPM)
A1016	Neat Material Source	NA	93.2	932.0
A1221	Neat Material Source	NA	106.8	1068.0
A1232	Neat Material Source	NA	103.3	1033.0
A1242	Neat Material Source	NA	99.0	990.0
A1248	Neat Material Source	NA	101.9	1019.0
A1254	Neat Material Source	NA	99.6	996.0
A1260	Neat Material Source	NA	99.2	992.0
DCB	Chem Service	F2170	10	100.0

Unless otherwise noted hexane is the solution used to make all dilutions.

Table 2
Example PCB Working Standard Preparation Table

PCB Stock Standards	Init. Volume(mL)	Final Volume(mL)	Conc.(PPM)
A1016	1.0	100	9.32
A1221	1.0	100	10.68
A1232	1.0	100	10.33
A1242	1.0	100	9.90
A1248	1.0	100	10.19
A1254	1.0	100	9.96
A1260	1.0	100	9.92

ATTACHMENT A cont'd

Table 3
Example PCB Calibration Standard Preparation Table

Init. Volume (mL)	Final Volume (mL)	Final Concentration (PPM)					
		A1016	A1221	A1232	A1242	A1248	A1260
5.0	50	0.932	1.068	1.033	0.990	1.019	0.992
2.5	50	0.466	0.534	0.5165	0.495	0.5095	0.496
1.25	50	0.233	0.267	0.25825	0.2475	0.2548	0.248
1.00	50	0.1864	0.2136	0.2066	0.198	0.2038	0.1984
0.500	50	0.0932	0.1068	0.1033	0.0990	0.1019	0.0992
5.0*	50	0.01864	0.02136	0.02066	0.0198	0.02038	0.01984

*This initial volume is of the nominal 0.250 ppm standard. All others are from the nominal 10 ppm standard.

Table 4
Example PCB Aroclor-1254 Calibration Standard Preparation Table

Init. Volume (mL) A1254	Init. Volume (mL) Surrogate	Final Volume (mL)	Final Concentration(PPM)		
			A1254	TCMX	DCB
5.0	0	50	0.996	0	0
10.0	4.0	100	0.996	0.020	0.200
25.0*	0	50	0.498	0.010	0.100
1.25	0.800	50	0.249	0.008	0.080
0.500	0.500	50	0.0996	0.005	0.050
0.100**	0.200	50	0.01992	0.002	0.020

*This initial volume is of the A1254 0.996ppm solution with surrogates.
**This initial volume is of the A1254 0.996ppm solution without surrogates.
All others are from the A1254 9.96ppm working standard.

ATTACHMENT B

Table 1
PCB Continuing Calibration Stock Standards

PCB	Supplier*	Catalog #*	Conc. (μg/mL)
A1016	Chem Service	F107AS	1000
A1221	Chem Service	F108AS	1000
A1232	Chem Service	F113AS	1000
A1242	Chem Service	F109AS	1000
A1248	Chem Service	F110AS	1000
A1254	Chem Service	F111AS	1000
A1260	Chem Service	F112BS	1000

*Or Equivalent.

Table 2
PCB Continuing Calibration Working Standards

PCB	Initial Volume(mL)	Final Volume(mL)	Concentration(PPM)
A1016	1.0	100	10
A1221	1.0	100	10
A1232	1.0	100	10
A1242	1.0	100	10
A1248	1.0	100	10
A1254	1.0	100	10
A1260	1.0	100	10

ATTACHMENT B cont'd

Table 3
PCB Continuing Calibration Standards

PCB	Initial Volume(mL)	Final Volume(mL)	Concentration (PPM)
A1016	2.5	50	0.500
A1221	2.5	50	0.500
A1232	2.5	50	0.500
A1242	2.5	50	0.500
A1248	2.5	50	0.500
A1254	2.5	50	0.500
A1260	2.5	50	0.500

ATTACHMENT C

Gas Chromatograph Operating Procedures[1]

Column Type	Capillary
Column ID	DB-1
Vendor	J&W (or equivalent)
Part Number	122-1032
Column Length(m)	30
ID(mm)	0.25
Film Thick.(um)	0.25
1)Initial Col. Temp. (^{o}C)	140
1)Col. Hold Time (min.)	1.0
1)Col. Temp. Rate (^{o}C/min.)	10
1)Final Col. Temp. (^{o}C)	200
1)Col. Hold Time (min.)	NA
2)Col. Temp. Rate (^{o}C/min.)	5
2)Final Col. Temp. (^{o}C)	245
2)Col. Hold Time (min.)	14.50
GC Col. gas flow rate (mL/min.)	17-24
ECD autozero	Yes
Detector Temp.(^{o}C)	300
Init. Injector Temp. (^{o}C)	300
A/S Vial Needle Depth	85
A/S Solvent Select	3
A/S Upper Air Gap	Yes
A/S Lower Air Gap	Yes
A/S Viscosity Factor	1

ATTACHMENT C cont'd

Gas Chromatograph Operating Procedures[1]

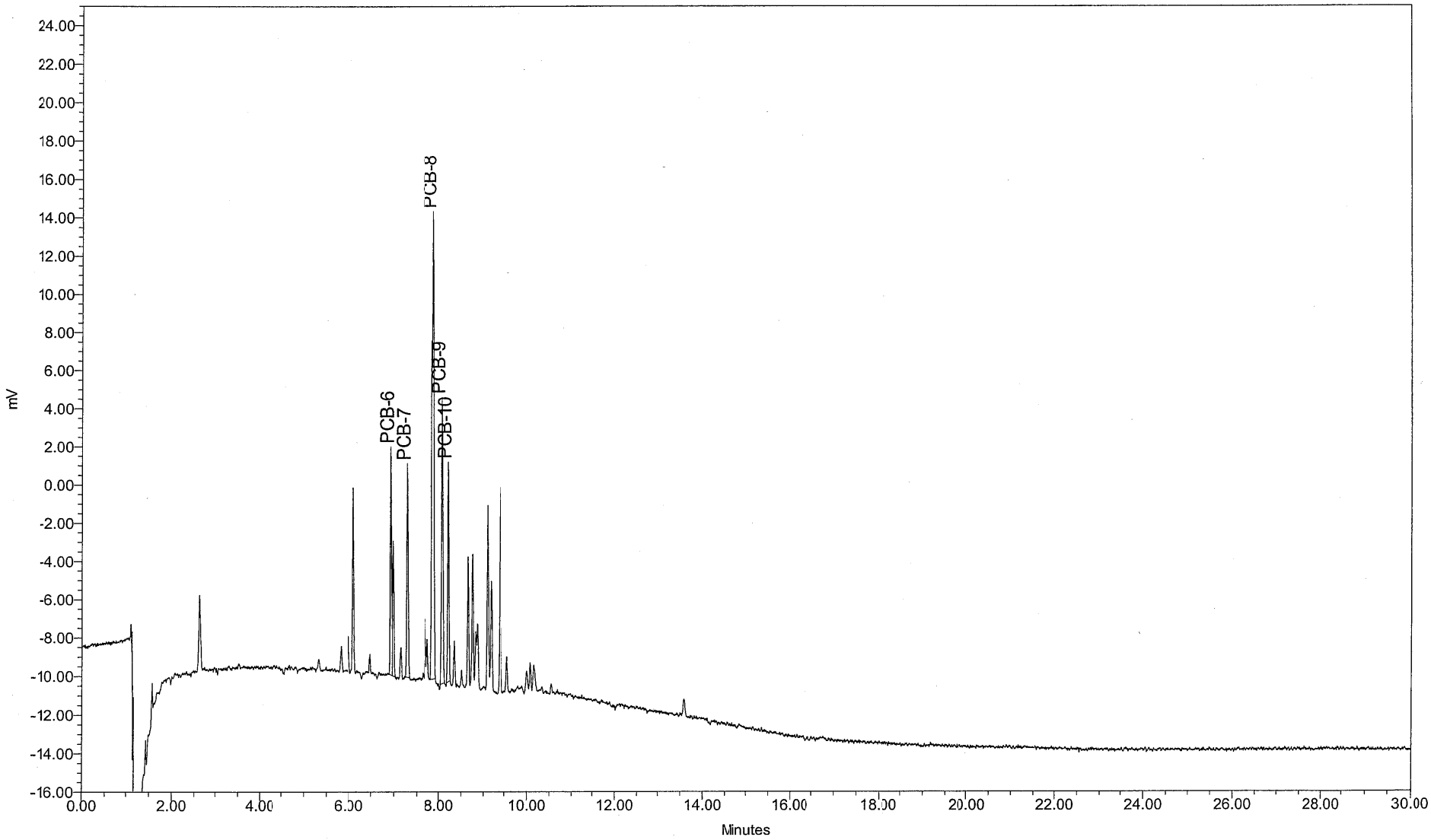
A/S Hot Needle Time (min.)	0.05
Autosampler (A/S) Model Number	8100 (or equivalent)
A/S Injection Volume (uL)	Lab-determined
A/S Injection Time (min.)	0.01
A/S Injection Rate (uL/sec.)	Fast 4.0
A/S Solvent Inj. plug size (uL)	0.2

Note:
1 – Parameters can be adjusted as necessary for the specific instrument used by the laboratory provided that chromatography for quantitation peaks is consistent with the examples in this SOP.

ATTACHMENT D
DB-1 CHROMATOGRAMS

Chromatogram Report, PCB by SW846 Method 8082

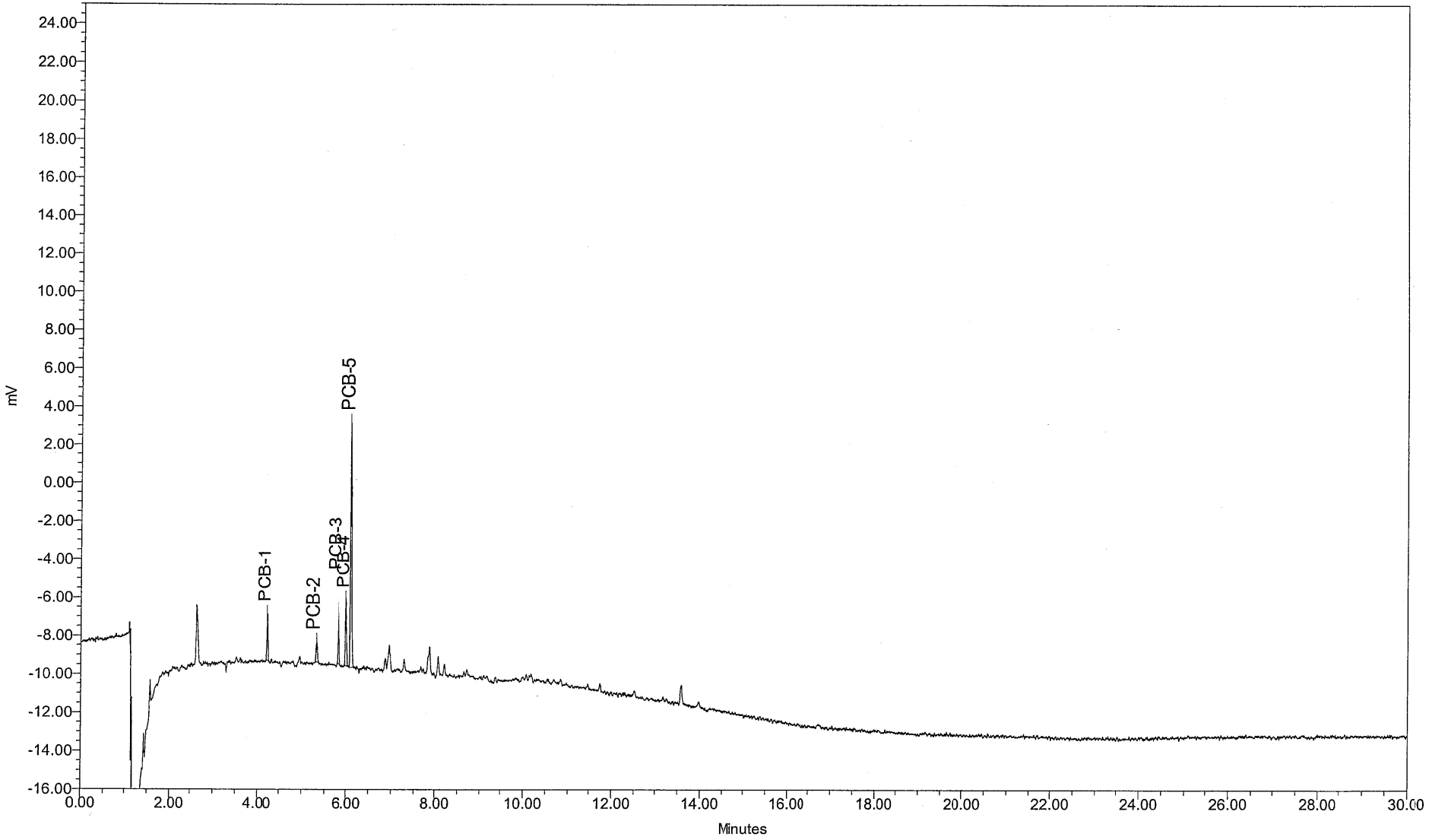
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS160725	Sample Amount:	1
Sample ID:	A1016 500 PPB	Dilution:	1
Date Acquired:	07/26/1999 09:32:16	Processing Method:	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

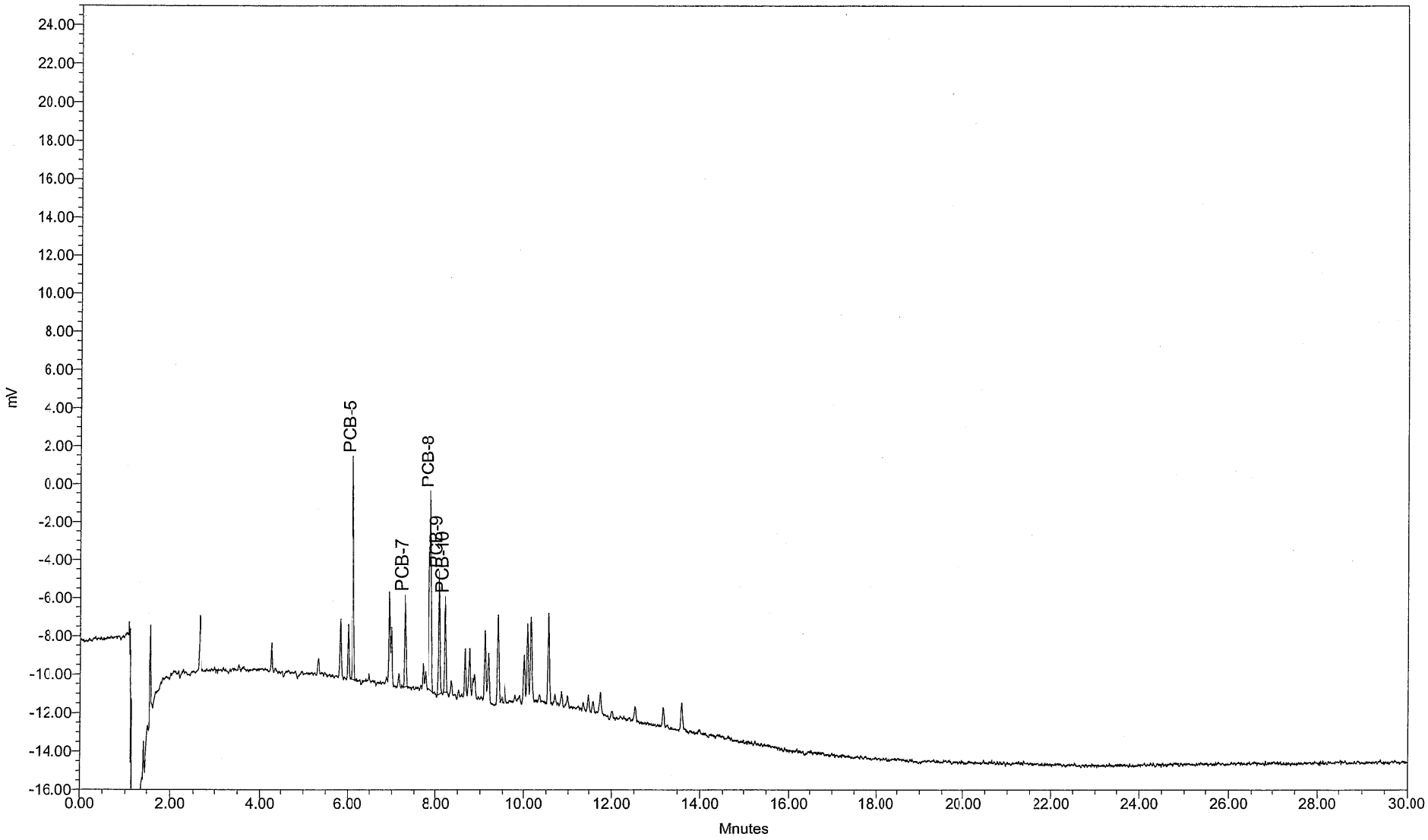
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS210725	**Sample Amount:**	1
Sample ID:	A1221 500 PPB	**Dilution:**	1
Date Acquired:	07/26/1999 10:08:26	**Processing Method:**	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

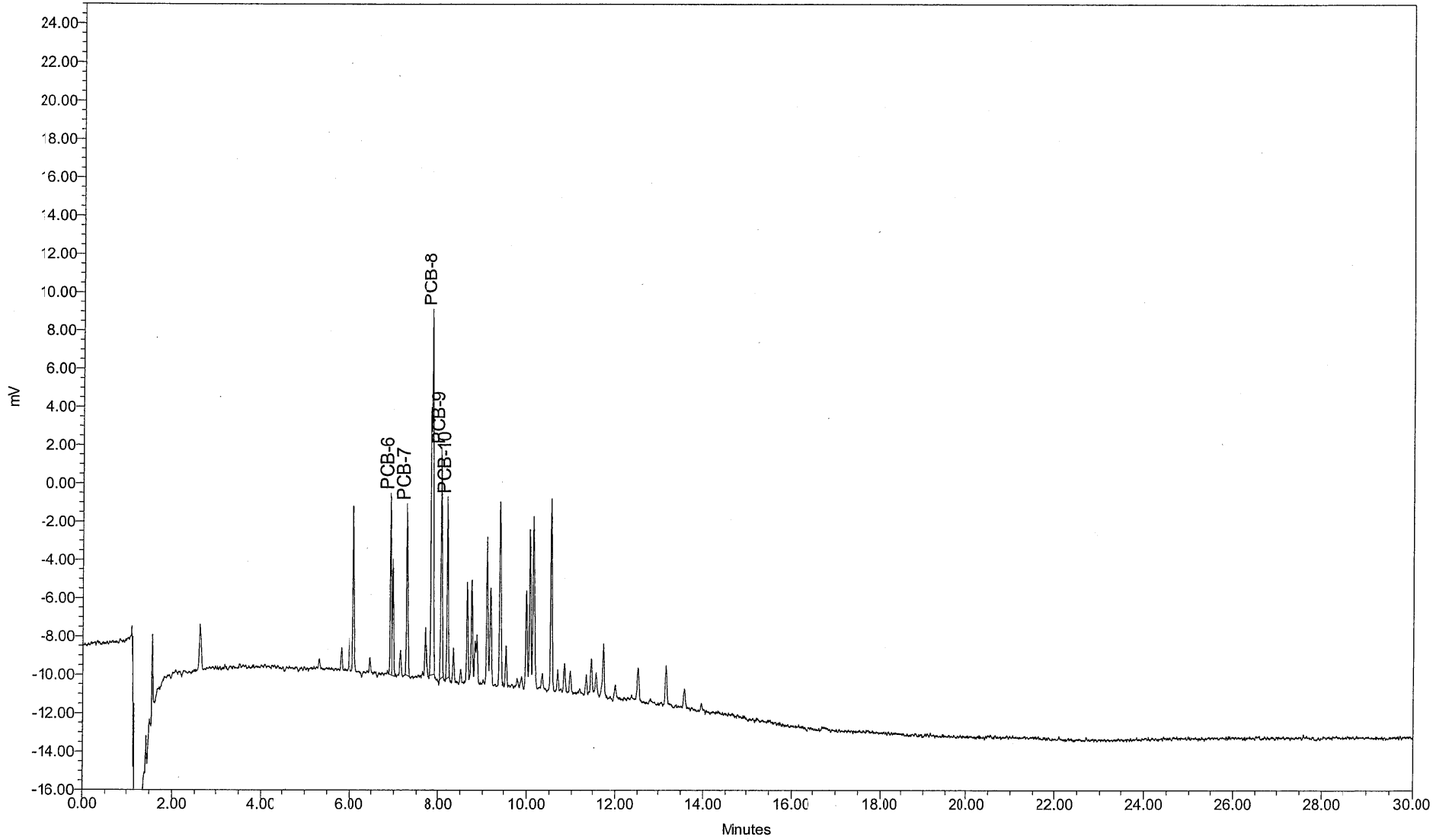
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS320725	**Sample Amount:**	1
Sample ID:	A1232 500 PPB	**Dilution:**	1
Date Acquired:	07/26/1999 11:09:59	**Processing Method:**	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

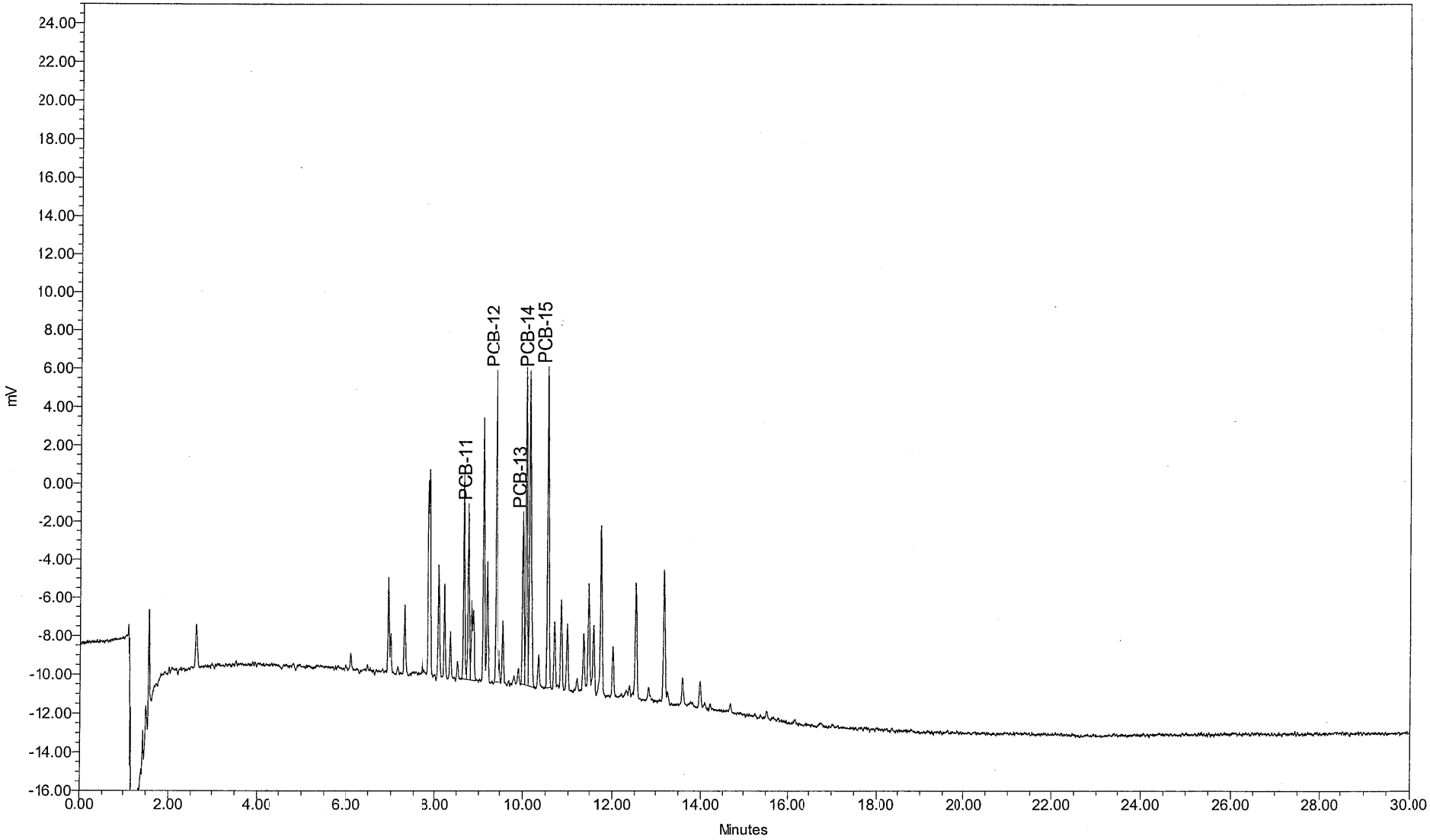
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS420725	Sample Amount:	1
Sample ID:	A1242 500 PPB	Dilution:	1
Date Acquired:	07/26/1999 11:46:07	Processing Method:	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

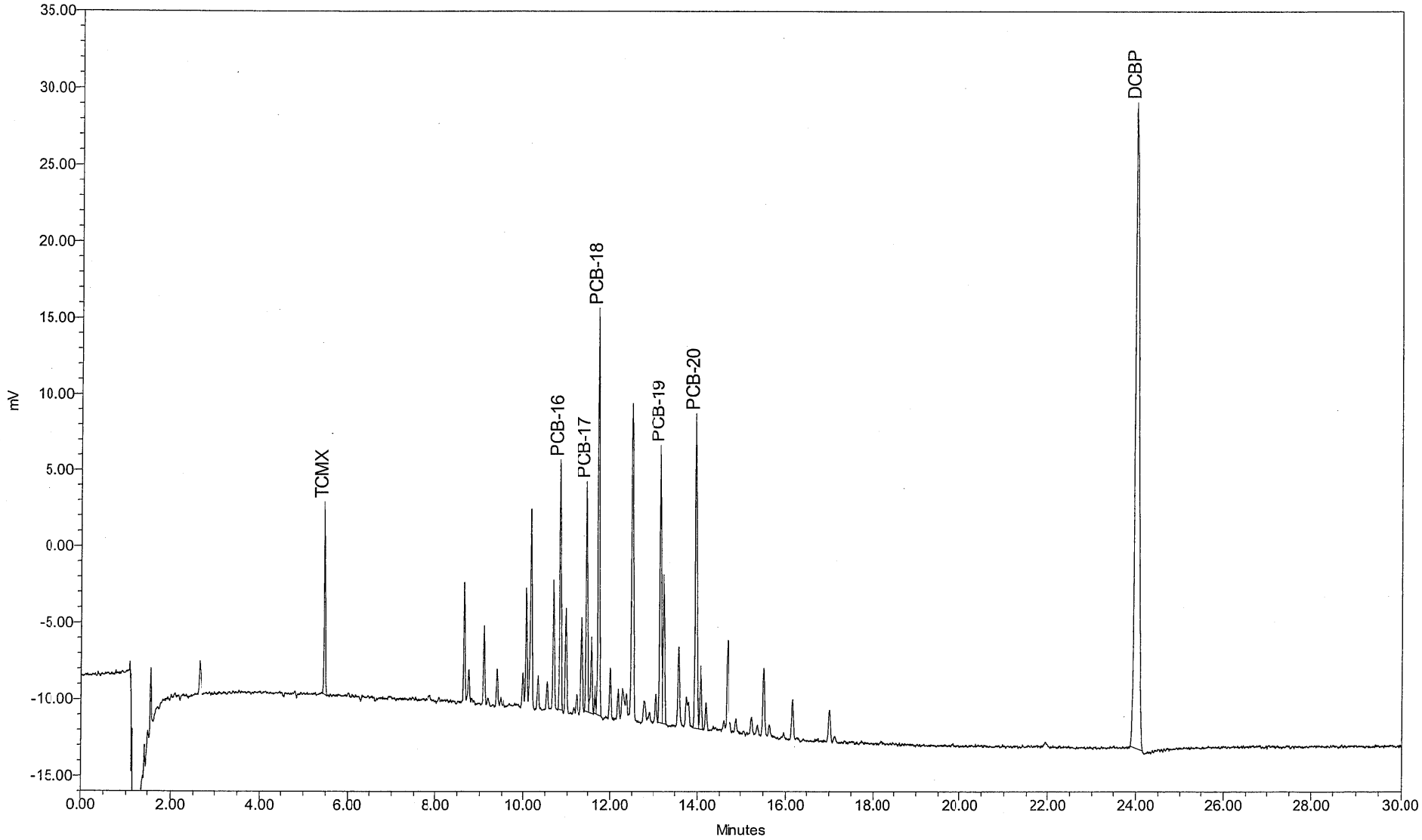
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS480725	**Sample Amount:**	1
Sample ID:	A1248 500 PPB	**Dilution:**	1
Date Acquired:	07/26/1999 12:22:14	**Processing Method:**	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

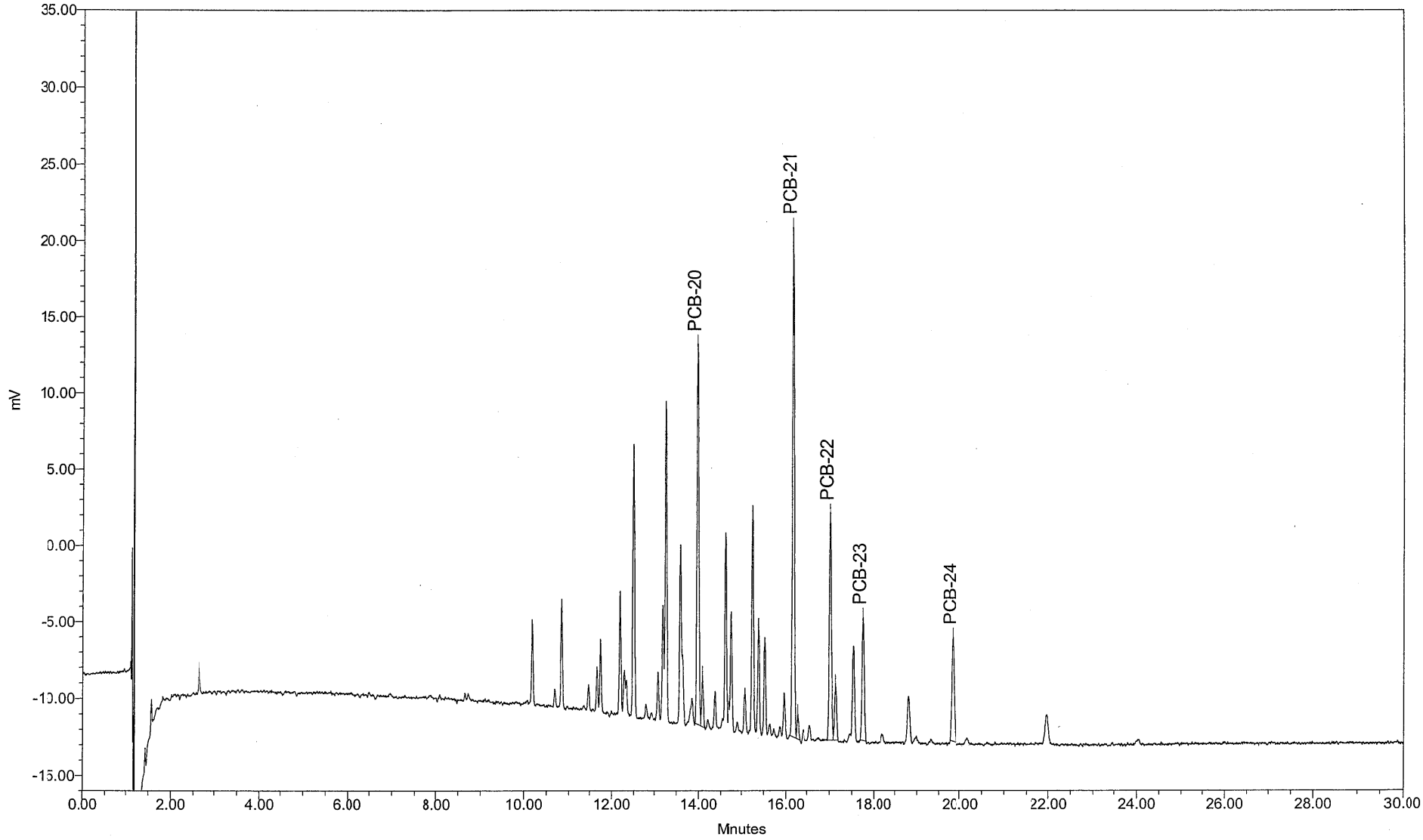
Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS540725	Sample Amount:	1
Sample ID:	A1254 500 PPB	Dilution:	1
Date Acquired:	07/26/1999 12:58:21	Processing Method:	GC7_8082_060899

Chromatogram Report, PCB by SW846 Method 8082

Northeast Analytical, Inc., 2190 Technology Drive, Schenectady, NY 12308
Phone: (518)-346-4592 Fax: (518)-381-6055 e-mail: nelab@aol.com



Sample Name:	CS500725	**Sample Amount:**	1
Sample ID:	A1260 500 PPB	**Dilution:**	1
Date Acquired:	07/26/1999 13:34:27	**Processing Method:**	GC7_8082_060899

ATTACHMENT E
RETENTION TIME WINDOWS

Northeast Analytical Inc 11/01/99

Retention Time Window Study
for Aroclors (PCB) by GC/ECD
EPA Method 8082

Instrument: GC 7
Column: DB-1

Analyte	PEAK	Standard 1 500 PPB R.T. Min	Standard 2 500 PPB R.T. Min	Standard 3 500 PPB R.T. Min	STD. DEV Min	%RSD	Window +/- Min.
		CS__0919	CS__1003	CS__1011			
Aroclor 1016	6	6.902	6.922	6.876	0.0231	0.33	0.069
	7	7.260	7.228	7.232	0.0174	0.24	0.052
	8	7.852	7.818	7.823	0.0184	0.23	0.055
	9	8.051	8.018	8.022	0.0180	0.22	0.054
	10	8.185	8.151	8.155	0.0186	0.23	0.056
Aroclor 1221	1	4.212	4.199	4.190	0.0111	0.26	0.033
	2	5.294	5.277	5.269	0.0128	0.24	0.038
	3	5.787	5.775	5.765	0.0110	0.19	0.033
	4	5.962	5.951	5.941	0.0105	0.18	0.032
	5	6.072	6.062	6.051	0.0105	0.17	0.032
Aroclor 1232	5	6.080	6.050	6.059	0.0154	0.25	0.046
	7	7.258	7.227	7.237	0.0158	0.22	0.047
	8	7.852	7.819	7.829	0.0169	0.22	0.051
	9	8.050	8.018	8.028	0.0164	0.20	0.049
	10	8.184	8.152	8.163	0.0163	0.20	0.049
Aroclor 1242	6	6.894	6.927	6.872	0.0277	0.40	0.083
	7	7.251	7.234	7.228	0.0119	0.16	0.036
	8	7.844	7.826	7.820	0.0125	0.16	0.037
	9	8.043	8.025	8.020	0.0121	0.15	0.036
	10	8.178	8.159	8.155	0.0123	0.15	0.037
Aroclor 1248	11	8.724	8.689	8.700	0.0179	0.21	0.054
	12	9.352	9.313	9.324	0.0201	0.22	0.060
	13	9.965	9.927	9.938	0.0196	0.20	0.059
	14	10.122	10.082	10.094	0.0205	0.20	0.062
	15	10.511	10.470	10.480	0.0214	0.20	0.064
Arolcor 1254	16	10.795	10.773	10.767	0.0147	0.14	0.044
	17	11.431	11.409	11.403	0.0147	0.13	0.044
	18	11.703	11.680	11.673	0.0157	0.13	0.047
	19	13.139	13.113	13.108	0.0166	0.13	0.050
	20	13.931	13.907	13.902	0.0155	0.11	0.047
Arolcor 1260	20	13.942	13.896	13.911	0.0235	0.17	0.070
	21	16.125	16.081	16.093	0.0227	0.14	0.068
	22	16.985	17.049	16.943	0.0534	0.31	0.160
	23	17.717	17.665	17.675	0.0276	0.16	0.083
	24	19.799	19.732	19.750	0.0347	0.18	0.104
TCMX (SURROGATE)	Surr.	5.445	5.429	5.425	0.0106	0.19	0.032
DCB (SURROGATE)	Surr.	23.984	23.91	23.91	0.0439	0.18	0.132

ATTACHMENT F
QUALITY CONTROL REQUIRMENTS
SUMMARY TABLE

Summary Table GEHR8082

Polychlorinated Biphenyls - SW-846 Method 8082
Quality Control Requirements

Quality Control Item	Frequency	Acceptance Criteria	Corrective Action
Sulfuric Acid Cleanup, Sulfur Cleanup, Florisil Cleanup	All samples for PCB only.	Not applicable.	Not applicable.
Initial Calibration	• Established initially and when CCC fails criteria. • At 5 concentration levels for Aroclors -1221, -1242, and -1254 and surrogate compounds (TCMX and DCBP). The 5 concentration levels are to be 20 ng/mL, 100 ng/mL, 250 ng/mL, 500 ng/mL, and 1000 ng/mL for each Aroclor. The surrogate compounds are to be combined with the Aroclor 1254 standards at concentrations of 2 ng/mL, 5 ng/mL, 8 ng/mL, 10 ng/mL and 20 ng/mL (TCMX) and 20 ng/mL, 50 ng/mL, 80 ng/mL, 100 ng/mL, and 200 ng/mL (DCB). • One standard calibration for each of the remaining Aroclor mixtures (1016, 1232, 1248, and 1260), at the reporting limit. If any one of these Aroclors is detected in a sample, the sample must be reanalyzed under a 5-point calibration for the detected Aroclor(s) for quantitation.	• %RSD≤20% among calibration factors (CFs) AND correlation coefficient ≥ 0.99 for each Aroclor mixture and surrogate (to be quantitated using linear-fit calibration curve not forced through zero). • Calibration factors are to be calculated using the total area for 5 peaks for each Aroclor. (Refer to SOP GEHR8082 Section 8.3.4 for selection of peaks.) • Each Aroclor must display distinctive pattern.	• Reanalyze the initial calibration curve and/or evaluate/correct instrument malfunction to obtain initial calibration which meets criteria. • Sample results above highest standard concentration require dilution and reanalysis. • If Aroclors-1016, -1232, -1248, and/or -1260 is detected in a project sample, the instrument must be calibrated using 5 concentration levels (20 ng/mL, 100 ng/mL, 250 ng/mL, 500 ng/mL, and 1000 ng/mL) for the detected Aroclor(s) and the sample reanalyzed. Same acceptance criteria that applied to 5-point calibration for Aroclors -1221, -1242, and -1254 will apply to these Aroclors.

Summary Table GEHR8082

Polychlorinated Biphenyls - SW-846 Method 8082
Quality Control Requirements

Quality Control Item	Frequency	Acceptance Criteria	Corrective Action
Continuing Calibration Check (CCC) Standard	• CCC for each Aroclors -1221, -1242, and -1254 at the beginning of the daily sequence (when >24-hour break in continuous analysis), unless initial calibration is performed. • If <24 hours break, CCCs will be alternated among Aroclors -1221, -1242, and -1254 after each analysis of 10 samples. • All CCCs must contain TCMX and DCB. • If analytical run is being performed for quantitation of Aroclors-1016, -1232, -1248, and/or -1260 (refer to initial calibration), CCCs for Aroclor(s) to be quantitated must be analyzed at the same frequency required for Aroclors -1221, -1242, and -1254. • Analytical sequence must end with analysis of CCCs for each Aroclors-1221, -1242, and -1254 (and/or other Aroclors if to be quantitated).	• ≤15% Drift based on "true" concentration for each Aroclor and surrogate when quantitated as a sample. • RT of each peak used for identification of the Aroclor must be within RT window (reset daily at the beginning of the sequence for the 24-hour day). • All samples must be bracketed by CCCs for Aroclors -1221, -1242, and -1254 (and/or other Aroclors if to be quantitated) that meet all criteria stated above.	• Correct system, if necessary, and recalibrate. Criteria must be met before sample analysis may begin. Samples that are not bracketed by compliant CCCs must be reanalyzed. • If a failed CCC returns to acceptable calibration later in the sequence, samples following the acceptable CCC will be reported; and samples between the failed CCC and subsequent compliant CCC will be reanalyzed.
Retention Time (RT) Windows	1. Established at ± 3 × std. dev. of RT of three standard analyses over 72-hour period. Must establish whenever a new column is installed. (Default RT window is ±0.08 minutes - Refer to SOP GEHR8082 Section 8.4 for additional guidance.) 2. RT windows are recentered daily based on RT of each of the peaks used for Aroclor identification in the first CCC of the day. (Refer to SOP GEHR8082 Section 8.5.4 for guidance on setting daily RT windows for Aroclors not analyzed as part of initial CCC.)	• RT of CCC peaks must be within established windows in the CCCs analyzed throughout day. • Recentering windows is permitted only once per 24 hours.	Adjust system, reestablish RT windows, and recalibrate.
Retention Time (RT) Shift	Each CCC analysis: RT of the peaks chosen for the identification of the Aroclors in the CCC are evaluated against the first CCC of the day.	Each quantitation peak for each Aroclor and each surrogate peak should be within window established.	Inspect chromatographic system for malfunction; correct identified malfunctions, if appropriate.

Summary Table GEHR8082

Polychlorinated Biphenyls - SW-846 Method 8082
Quality Control Requirements

Quality Control Item	Frequency	Acceptance Criteria	Corrective Action
Method Blank	• One per extraction batch of ≤20 samples of the same matrix per day. • Must be analyzed on each instrument used to analyze associated samples. • Must undergo all sample preparative procedures.	• Concentration does not exceed the reporting limit of any Aroclor. Not applicable if positive results were not reported for any associated samples. • Must meet surrogate criteria.	1. Reanalyze blank to determine if instrument contamination was the cause. If the method blank is still non-compliant, then follow 2 below. 2. Reextract and reanalyze all associated samples.
QC Reference Standard - Laboratory Control Sample (LCS)	One per extraction batch of ≤20 samples per matrix per day. The LCS must be from a second source and contain Arcolor 1242 at a concentration of 500 ng/mL at the instrument.	• % Recovery of Aroclor 1242 within project limits of 60-140%. • Must meet surrogate criteria.	Reanalyze LCS. If still out, reextract and reanalyze all associated samples. (Exception: If LCS recovery is high and no associated positives, then address in Case Narrative and no further action needed.)
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	At this time, the GE Hudson River Design Support Sediment Sampling and Analysis Program does not require the preparation and analysis of matrix spike and/or matrix spike duplicate samples. If requested in the future, one MS/MSD pair per extraction batch of ≤20 samples per matrix per day. The MS/MSD samples must be spiked with Arcolor 1242 at a concentration of 20,000 ng/mL at the instrument (note: this will require dilution).	• Aroclor 1242 % Recoveries within 60-140% (when MS/MSD spike concentration is greater than 4× the unspiked sample amount). • RPD within 40% (when MS/MSD spike concentration is greater than 4× the unspiked sample amount). • Must meet surrogate criteria (unless also outside of criteria in unspiked sample).	1. If recoveries for the spiked Aroclor are not within 60-140% or the RPD is >40%, check for documentable errors (*e.g.*, calculations and spike preparation). 2. Check unspiked sample results and surrogate recoveries for indications of matrix effects. 3. If no errors are found, and the associated LCS is within 60-140%, then sample matrix effects are the most likely cause. Note in Case Narrative.

Summary Table GEHR8082

Polychlorinated Biphenyls - SW-846 Method 8082
Quality Control Requirements

Quality Control Item	Frequency	Acceptance Criteria	Corrective Action
Surrogates	• TCMX and DCB are added to all standards, blanks, samples, and QC samples at a concentration of 10 ng/mL TCMX and 100 ng/mL DCB at instrument level. • Calibrated as a target compound in the Aroclor 1254 initial calibration standards.	% Recovery of at least one surrogate within 60-140% for samples analyzed at an extract dilution factor of 5 or less.	If both recoveries are not within limits: 1. Check to be sure that there are no errors in calculations and surrogate solutions. Also, check instrument performance. 2. If no problem is found, reextract and reanalyze the sample. 3. If the reanalysis is within limits and holding time, then report only the reanalysis. 4. If the reanalysis is within limits, but out of holding time, then report both sets of data. 5. If the reanalysis is still out of limits, then report both sets of data. 6. No reanalysis is required if the sample was chosen for the MS/MSD analysis and the MS and/or MSD are also outside limits.
Qualitative/Quantitative Issues	If Aroclors-1016, -1232, -1248, and/or -1260 are detected in a project sample analyzed under a single-point calibration for the detected Aroclor, the sample must be reanalyzed under a 5-point calibration for the detected Aroclor(s).	All positive results for Aroclors must be quantitated using a 5-point linear-fit calibration curve and must be bracketed by compliant CCCs containing the detected Aroclor.	If Aroclors-1016, -1232, -1248, and/or -1260 are detected in a project sample, the instrument must be calibrated using 5 concentration levels for the detected Aroclor(s) and the sample reanalyzed. Same acceptance criteria that applied to initial calibration and CCC analysis for Aroclors -1221, -1242, and -1254 will apply to these Aroclors.
	If instrument level of any Aroclor in a sample exceeds the instrument level of that Aroclor in the highest level standard, the sample must be diluted to approximately mid-level of the calibration range and reanalyzed.	The instrument level of all Aroclors must be within the calibration range for all samples.	Dilute the sample to bring the level of the highest concentration of Aroclors within the calibration range.